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THE Interstate Commerce Commission has suspended proposed advances in the rates on ice over the Minneapolis, St. Paul & Sault Ste. Marie and about 50 other roads. The rates were to have gone into effect June 5, but are suspended until September 2, pending an investigation of the reasonableness of the higher rates. As the ice business in the region of "The Soo" is not likely to be very flourishing in the fall, this suspension may be looked on as virtually a final cancellation of the proposed rates. The increase, if it is needed at all, is needed in the summer. The Mann-Elkins amendment, therefore, has empowered the Interstate Commerce Commission to annul an increased rate without a hearing. It would be interesting to know in a case like this, where it seems obvious that the suspension of advance rates by the commission amounts, for all practical purposes, to a prohibition of these rates, whether the Commerce Court might not rightfully enjoin the commission from taking such arbitrary action.

THE Supreme Court has finally loosened the anti-trust law.

This has been done, however, by a course of reasoning which Justice Harlan denounces in vigorous terms, and on the same day, the court reasserts the natural love of lawyers for strict construction by declaring valid the law which in the matter of automatic car couplers requires of the railways absolute perfection. This view is not new, for we have had substantially the same opinion in previous cases. To run for a single mile a car with an unworkable coupler makes a railway company a law-breaker. The only apparent explanation of this different treatment of different subjects is in the real or supposed difference in their magnitude. The trust cases are so important that eight judges have taken all winter to discuss the subject with sufficient thoroughness to develop a common ground on which all of the eight could stand. The coupler question, however, is looked at by lawyers, no doubt, as a mere detail of police regulation. But in actual application the two laws are alike. Both are unworkable. To get along with the anti-trust act the Supreme Court substitutes for the law its own common sense. To keep the railways running, in spite of the impossible demands of the safety appliance acts, the adoption of common sense in place of the law is equally necessary, but the task of making the adjustment has been left to the administrative body, which, in the past, has meant Mr. Moseley. Only by the omission of the government to enforce the coupler law have we been able to endure it. In Justice Harlan's dissenting opinion, this combination loose-construction-strict-construction position was referred to. "At this term of the court," said Justice Harlan, "lawyers have been 'compelled to sit down' and cease arguing against a view that has been settled by a former decision of the court. At any rate, within the last hour, an opinion [on the safety appliance act] has been handed down, in which it was said that . . . the question of the meaning of the act, so far as it relates to couplers, would not be reopened."

THE block system—the method of keeping trains apart by the regular maintenance of space-intervals instead of by doing without the space interval and trusting to clocks, flags and other things—is one of the simplest things in the world; but when it comes to be discussed in public by government officers and railway lawyers it seems to be one of the most confusing. A recent press despatch from Ottawa, Ont., says:

"The proposal of the railway commission to compel the railways to install the block system came up for discussion at the meeting of the board on May 4. The Canadian Pacific and the Grand Trunk both maintained that the protection given their trains was as good as the block system. They held that the block system was only instituted where the traffic was dense to enable them to run trains closer together. It was safer to run them farther apart without the system. It was pointed out by the chairman of the board that there was an average of 115 killed or injured in railway accidents each year in Canada, which would indicate that the protection was not so complete as was claimed. One of the railwaymen said that 40 per cent. of the accidents were due to disregard of signals, and if the employees would disregard a semaphore they would also disregard a block system."

The first point noticeable in this item is the difficulty of getting

the matter clearly before the public. We can hardly blame the reporter for inaccurate use of the terms "semaphore" and "block system," for railway men themselves often use such terms carelessly and in a wrong sense. The statement "115 killed or injured" is almost wholly meaningless, for it may mean 1 killed and 114 slightly injured, or the ratio may be something else. The killed may have been victims of some derailment which would not be prevented by the introduction of the block system. This small number of killed and injured from all railway accidents, or even from all train accidents, would be a favorable record, comparing with other countries. Perhaps, however, this was an error of the reporter rather than of the commissioner. "Forty per cent. due to disregard of signals." Who ever found anything instructive in such percentages as this? It is as useless to cite this figure as to compare the tonnage of freight passing through Chicago with the weight of the pyramids of Egypt. Whatever the percentage of enginemen disregarding signals, the only proper stand for the railway officer to take is to diagnose the trouble in *all* those enginemen and then do his best to remove it. And every railway officer knows that the block system is always one of the best promoters of good discipline.

BUT the main argument of the railways is weak. It was in 1887, we believe, that the Canadian Pacific first advertised that it used the block system on its line from Winnipeg to the Pacific coast. Density of traffic cannot have been the reason for adopting it there. Do they mean to say that they have abandoned it and feel safer without it? The farther apart trains are run, the greater the safety; but to add "without the block system" is absurd. Probably the railway men did not say this, but the reporter, quite likely, was fully justified in assuming that that was intended to be the real meaning of their words. Whether trains follow one another in ten minutes, or in two hours, the space interval remains superior to the time interval, for the reason that space-interval operation is always the same, needing no adjustment to different time intervals, whereas time-interval regulation of trains is never absolute, but always depends on the aid of the flagman and other uncertain factors. The problem of the commissioners in this case is so to master the subject as to take a comprehensive view; a view extending 10 or 20 years into the future, perhaps. For the railways, claiming that their present system is as good as the block system, may for several years make good that claim, especially if the number of persons killed and injured is the only criterion. Bad collisions may come ten years apart; the trouble is that when they do come they are so distressing that the public at once demands, without delay a change that may take time to accomplish. If the commissioners of Canada, or of any other country, wish to make really intelligent and illuminating estimates of the need of improvement in railway train spacing they should gather the facts relative to all cases of error or neglect which produce the possibility of death and disaster. The accident records show many collisions which wreck only empty passenger cars; but the lesson of these should be just as useful as though a score of persons had been killed.

THE Baltimore & Ohio yard at Chicago Junction, Ohio, described in another column, is worthy of special attention for several reasons. The most important of these is the absence of a departure yard. Although the general practice in building gravity yards has been to provide departure yards, many operating men are questioning whether they are really needed. Many claim that it is necessary to provide such a yard to afford a place where trains can be made up and air brakes properly inspected and tested in accordance with government regulations. Others maintain, on the other hand, that if the tracks in the classification yard are made long enough to hold full trains such work can be done in this kind of yard as well as in a flat yard, thus saving the additional moving of the cars

and requiring less track room. It should also be taken into account that the cost of operating and maintaining a switching engine is equivalent to the interest on \$200,000 annually; and therefore an outlay approaching this amount would be justified to eliminate one engine.

The details of the yard have been worked out with great thoroughness, and it has been built to a high standard. The use of 85-lb. rail with hard center frogs may be regarded by some as unwarranted, but careful consideration will convince most persons who are familiar with yard work that their use will cause economy in maintenance and is in accordance with the best standards. The same thing may be said of the construction of the various smaller buildings throughout the yard and of the very complete conveniences provided for employees. The provision in yards of individual lockers and washstands, with hot and cold water, is not common, but perhaps the expenditure for them will be compensated for by the satisfaction they will give to the men and the better work they will be prompted to do by this evidence of the management's interest in their welfare.

In view of the care shown in the design of most of the yard, one is surprised to note in contrast that 12 ft. centers were adopted. With the large equipment now in use, and the threatening danger of legislation regarding clearances, it would have seemed advisable to have built to wider centers. To increase centers after the yard is built would be almost equivalent to rebuilding it.

A RAILWAY with small relative capitalization in stock and resulting small dividend requirement is apt to be either a prince or a pauper. In good years it can pay a handsome dividend and carry over a large surplus. In a bad year or in other adverse conditions the small dividend margin is easily exhausted. Such has been the case with the Boston & Maine, which, after dividends for 67 years rising at one time as high as 10 per cent., has now reduced its rate from 6 per cent. to 4. The system, with its road mileage of 2,290, and single track mileage of 4,175, has been working with the low capital of \$31,991,490, which its new capital of about \$10,000,000 for improvements will not increase over much, especially when its terminals in large New England cities, including Boston, are reckoned in. But, although it has carried a funded debt of but \$42,073,000, it has been burdened with a great fixed charge—last year \$7,882,361, of which no less than \$5,265,497 was in the form of leases. Its gross earnings last year were \$43,357,175, or \$11,365,685 more than its capital stock; yet fixed charges, as a prime factor, reduced in a pretty good year net earnings for dividends to \$2,850,621. Since then have come the great increase in wages, larger in the case of the Boston & Maine than most roads, because lower before, and affecting also the important subsidiary, the Maine Central. There has been also recent depression of business in the large textile industry of the road's territory. But underlying the whole situation has been the Boston & Maine's stagnation in the past and a policy of skinning plant and equipment. It has been, indeed, almost an archaic system. A traveler coming down from the White mountains in one of its express trains of a dozen cars on a Monday of early September could well nigh read the history of American railway equipment in the diverse quality of cars by a simple walk through the train—including the old fashioned water boy. The recital of such conditions, financial and physical, not only explains the reduction in dividend but justifies it and would probably have justified even greater reduction. As a balm for minority stockholders they will read President Mellen's prophecy that the system will be a strong dividend earner with rehabilitation and new efficiency, including the electrified Hoosac tunnel. Not so comforting will be their back thought on how they might have exchanged their shares for those of the New Haven, but for Massachusetts' legislative and judicial intrusion three or four years ago.

THE reorganization plan of the International & Great Northern, a summary of which is given in our news columns, shows how difficult, if not almost impossible, it would be to reorganize a Texas road which had gone into the hands of a receiver if the securities of such a road were held by a large number of different investors. In the case of the International & Great Northern, the Gould estate is the owner of all of the \$9,755,000 stock and a majority of the \$2,966,052 4 per cent. third mortgage bonds. Under the plan of reorganization, which has necessarily been made so as to fit in under the capitalization prescribed by the Texas Railway Commission, the stock is entirely wiped out and holders of the third mortgage bonds are to receive common stock of the new company in exchange for their bonds. Moreover, the unsecured claims, most of which are held by the Gould interests and which amounted to \$4,000,000, have apparently been satisfied with the payment of \$1,321,000, and it was understood that no part of this payment was to the Goulds. According to the *Wall Street Journal*, the bankers who bought the \$11,000,000 5 per cent. notes from the company paid 95, which would give the company \$10,450,000 cash out of the total estimated to be raised under the reorganization plan—\$15,340,000. As will be seen by reference to the plan, the company also sold for cash \$1,600,000 first refunding bonds to a syndicate headed by the Equitable Trust Company and the *Wall Street Journal* says that this syndicate paid over 90 for its bonds, and estimates, therefore, that a valuation of not less than \$85 per share is placed on the preferred stock. On the basis of 85 for the preferred, the price at which the syndicate bought \$2,500,000 common should be about \$22 per share, and since the third mortgage bond holders receive common stock at par for their holdings this would be fairly close to the price at which the third mortgage bonds have been selling. In the case of the International & Great Northern, such a drastic reduction in par value of securities was possible because one set of interests very largely owned and controlled the property and were so thoroughly identified with it that they were necessarily willing to make a large present sacrifice in the hopes of some future return, but the hardships that would have been suffered by a large number of broadly-scattered investors under any such drastic plan would make it very doubtful whether they would ever be brought to accept it.

THE STANDARD OIL CASE DECISION.

THE decision of the Supreme Court in the Standard Oil case completed the court's reversal of its own decisions in the Trans-Missouri Freight Association and the Joint Traffic Association cases. In those cases it held that the Sherman anti-trust law was "not limited to that kind of contract which is in unreasonable restraint of trade," but prohibited all contracts in restraint of trade, whether reasonable or unreasonable, and that "no exception or limitation can be added without placing in the act that which has been omitted by Congress." Chief Justice White—then Associate Justice White—dissented at that time from the majority opinion, which was written by Justice Beckham. He contended that the words "restraint of trade" under the common law really meant "unreasonable restraint of trade," and that the Sherman law should be read in the light of the common law, and should be held to prohibit only combinations which were unreasonable in their purpose and effect.

Several later decisions have indicated a disposition on the part of the court to withdraw from the extreme position taken by it in the traffic association cases. These were regarded by Victor Morawetz, one of the most eminent authorities on corporation law in the United States, as so significant that within the last year he contended, in a published article, that no amendment of the act was necessary in order to protect reasonable combinations. The opinion of Chief Justice White in the Standard Oil case shows that Mr. Morawetz was right. The chief justice, by some rather metaphysical reasoning, seeks to show that the court has not reversed itself. Most lawyers will,

however, agree with Justice Harlan that it has done so. On the other hand, they are apt to differ from his view that it ought not to have done so. Most persons who have studied the history of the Sherman act believe that the original decisions of the court gave to it a meaning not intended by Congress at the time of its enactment in 1890, while the decision in the Standard Oil case gives effect to the original intention of the lawmakers.

To railway men the decision is of course, of interest, mainly because of the new precedent it may establish for decisions in railway cases. But the exact amount of comfort that they are justified in extracting from it is doubtful. Chief Justice White, in speaking of the criteria of reasonableness to be applied in different cases, referred repeatedly to the character of the parties by whom agreements were made or combinations formed. It is possible, and even probable, that he intended to hint that railways being public service corporations, agreements or combinations between them might be held unreasonable, which if made between industrial concerns would be held reasonable. But while such a distinction between the application of the law to railways and industrial concerns is hinted at, it has not been established; and it may therefore be assumed, until some decision is rendered establishing the contrary, that the position of the court now is that the law prohibits only unreasonable restraint of trade by concerns of any kind.

There are two classes of railway combinations on the standing of which before the law this decision may throw some light. These are, (1) mere agreements between competing railways regarding rates and service; and (2) combinations between competing railways effected and perpetuated by common ownership of their stock or by the ownership by one of the stock of the other. It has been generally understood, since the decision in the Trans-Missouri freight association case, that any agreement between competing railways to maintain or advance rates is unlawful. It is very questionable, in view of the Standard Oil decision, whether every agreement would now be held to be illegal. The question probably would be whether the particular restraint imposed on interstate commerce was reasonable or otherwise. The Interstate Commission now has power to reduce any unreasonable rate or to prevent any unreasonable advance in rates. It seems likely that the court would take this fact into consideration, and would hardly hold any agreement between railways regarding rates unlawful unless it deprived them of freedom to take individual action. If this theory be correct, the various existing traffic associations, and the conferences held and the arrangements made by the railways belonging to them regarding rates, are entirely legal; and perhaps such a proceeding as that brought by the government at Hannibal, Mo., almost a year ago against the western roads could not be successfully prosecuted. If the Supreme Court had held 15 years ago that the law prohibited only unreasonable agreements by competing railways, it is probable that more reasonable agreements regarding rates and service would have been made and that many combinations which have been brought about by acquirement of stock ownership would never have been formed.

How the decision may affect combinations effected between competing railways through stock ownership is a most interesting and important question. The result of the proceeding brought by the government against the Harriman Lines may settle whether the court will hold with respect to railways as well as industrial concerns that the law prohibits only unreasonable combinations, and whether it will apply the same criteria to the question of reasonableness in railway cases as industrial cases. If the courts should hold that the combination of the Union Pacific and the Southern Pacific is in violation of the law it could hardly hold otherwise regarding some other large railway combinations if cases involving them came before it.

The decision will tend to disarm the most severe criticisms that have been made against the Sherman law and probably will stop, at least temporarily, agitation for its repeal. Many have believed that the amendment of it chiefly needed was the inser-

tion of the words "unreasonable" before the words "in restraint of trade or commerce." The court has inserted this word by judicial legislation. No sane man wants unreasonable restraint of trade permitted or reasonable restraint of trade prohibited. The court has therefore made the law say what every sane man feels that it ought to say. The only point left to be settled is, as to whether the court or Congress shall be allowed to say what is reasonable and unreasonable. Certainly, before the authority to determine this question is taken from the court it should be given ample opportunity, in specific cases, to show more fully what is its conception of reasonableness.

LOCAL REGULATION OF RAILWAY OPERATIONS.

COMMISSIONER LANE, in an address before the Finance Forum of the New York Young Men's Christian Association, said that in his opinion one of the worst evils of American railway management is the centralization of control of thousands of miles of road in the offices of a few New York bankers. Mr. Lane insisted that interests of a comparatively small number of capitalists living in New York are entirely foreign to the interests of the population served by their railways.

In a general way railway men themselves have felt this as an evil. It has often been pointed out in these columns that absentee landlordism is a great misfortune for any road, and insofar as the policy of a railway is shaped not by the needs of operation of the physical plant but in accordance with a financial scheme, possibly having nothing to do with the working of the plant as a transportation agency, unquestionably much harm is done.

Commissioner Lane in his New York address proceeded almost immediately after his denunciation of centralized control to advocate a very strict regulation, amounting almost to management of railways of the United States, by a central commission located at Washington. In other words, he objected to the centralization of control of railways in New York, and advocated a centralization of control at Washington. A study of the work of such a commission as the New York up-state public service commission or of the railway commission of Wisconsin impresses one strongly with the advantages to be gained by local regulation. An intelligent state commission knows the problems in its own territory, both of the roads and of the people served by those roads far more intimately than can the Interstate Commerce Commission. Uniformity, desirable as it is in itself, is impracticable in a country as large and having as widely varied conditions as the United States. A commission thoroughly familiar with local conditions can settle grievances without formal complaint and trying of cases.

The faults that make such a regulation needed and demanded lie largely with railway managements. We are thoroughly in agreement with Commissioner Lane's statement that not enough power has been given to the men on the road. It is a rather interesting fact, however, that the railway system having probably the most highly centralized form of financial government of any in this country is the one that has gone furthest in giving extensive powers to its division superintendents. There is no railway system in the country whose machinery was more perfectly adapted for one-man absolute control than the Harriman system. Mr. Harriman had, in practice, most of the powers ordinarily exercised by a board of directors; and at the same time all, or more than all, of the powers usually given to the president; and yet this centralized authority was not used in such a way as to take away the initiative of subordinate local officers. The policy of the Harriman Lines, which has been carried out since Mr. Harriman's death along the same general principles pursued before his death, is to give more and more authority to the superintendent of each division, making him more nearly general manager of his 400 or 500 miles of line. He is thus able to adapt his methods of operation to local conditions and at the same time there is reserved to general officers of the system the power to formulate a comprehensive and uniform general policy.

The great trouble with state commissions is that they are so largely governed by political and too local considerations. One commissioner may be appointed or elected from one section of the state, and one from another, and each feels that he has a certain constituency whom he must protect at the expense of the rest of the state; and each state commission seeks to promote the interests of its state at the cost of those of the rest of the country. The Louisiana commission, as a whole, feels that it must protect Louisiana shippers and travelers at the expense of Texas shippers and travelers. The federal judicial department is so organized that there are circuit and district courts in every section, but from which appeal lies to the Supreme Court. Thus a uniform application of the federal constitution and statutes to cases arising under them is obtained, while securing to the people of each locality access to courts familiar with their local conditions. Would it not be possible to form some system of federal commissions or commissioners, subordinate to the Interstate Commerce Commission, but each having a limited territory under its jurisdiction? In this way a general uniformity of policy could be maintained, while the advantages of intimate local knowledge of varied conditions could be retained.

If there were some way in which the duties and activities of the various state commissions could be correlated with, but subordinated to those of the Interstate Commerce Commission, the existing state commissions might be made to serve local needs, much as the federal circuit courts now serve them, without losing sight, as they constantly do now, of the fact that, in the long run, the interests of each state or section will best be furthered by that railway policy which best promotes the welfare of the nation as a whole.

NEW BOOKS.

The Locomotive Headlight. By T. J. Hoskins, Chairman, Legislative Board, Brotherhood of Locomotive Engineers, State of Tennessee. 48 pages.

This is a pamphlet that has been compiled and published by the railway brotherhoods in Tennessee in advocacy of the use of the electric headlight on locomotives. A bill to require the use of the electric headlight has been pending before the legislature of that state. The pamphlet outlines the history of headlights from 1830 down to the present time. It discusses and endeavors to refute all the various arguments that have been made against the use of the electric headlight, both on lines of light traffic where there are no block signals, and on lines having larger traffic, where such signals are used. The conclusion reached by the author is that electric headlights are desirable under practically all conditions. Letters from a large number of engineers advocating the electric headlight are included.

An Investigation of Built-up Columns Under Load. By Arthur N. Talbot and Herbert F. Moore. Issued as Bulletin No. 44 of the Engineering Experiment Station, University of Illinois.

In the course of this investigation, laboratory tests were made on steel and wrought iron built-up columns, such as are used in bridges and other structures, to determine not only their strength but also the way in which the compressive stresses vary over the cross-section of the channels or other component parts of the column and throughout its length. The amount of stress in lattice bars and its variation from bar to bar was also measured. The distribution of stress over the cross-section of a lattice bar was studied. Field tests were conducted on the columns of a railway bridge under the load of a locomotive and train, and the distribution of stresses over various parts of the columns was measured. The investigation shows that the variations from the ideal column which result from shop and erection processes may be more important than the influence of length, and that on account of such causes the stresses at one or more points in a column may be as much as 50 per cent. in excess of the average stress. This investigation may be expected to have an important bearing on structural engineering practice. Copies of Bulletin No. 44 may be obtained from W. F. M. Goss, director of the Engineering Experiment Station, Urbana, Ill.

Letters to the Editor.

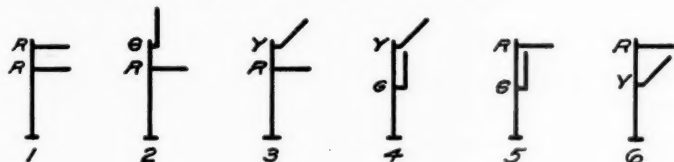
SIMPLICITY OF R. S. A. COMMITTEE'S SIGNAL ASPECTS.

CHICAGO, ILL., April 29, 1911

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have followed very carefully the subject of signal aspects ever since Committee No. 1, R. S. A. made its first report, and it has always seemed to me that a very simple subject was being befogged by a cloud of words. The fundamental question is, what do you want to tell an engineman? How you tell it is not of great importance, provided the message is clear. For example, you might write a set of instructions on the signal so that they could be read by an engineman after he had stopped his train. The main thing is to stop him when necessary. To make sure of doing this you must tell him at some point in advance that he may be expected to stop, otherwise momentum may take matters into its own hands. Instructions written on the signal would not do to give advance information, obviously. But if "caution," meaning "prepare to stop at some fixed point," can be indicated by the position of a signal arm, that is all that is necessary. If a bulletin board on each signal is unsatisfactory and information can be conveyed conveniently by an arrangement of lights and arms, whose peculiarities need not be comprehended until a train is standing still, then that is the thing to use, for such an arrangement will lend itself to other purposes and tend toward uniformity of appearance.

It appears to me that in the so-called majority report the scheme calls for but six aspects that differ from each other in any essentials and that need be comprehended from a train while running at speed. These are shown below.



The meanings of these aspects as given by the committee are as follows: 1. Stop. 2. Proceed. 3. Proceed prepared to stop at..... 4. Proceed prepared to pass next signal at limited speed. 5. Proceed at limited speed. 6. Proceed at limited speed, prepared to stop at..... The aspect known as No. 8 shown on page 305 R. S. A. Proceedings, 1909, meaning "Proceed prepared to stop short of any obstruction in the block" I consider to be merely a variation of No. 3, above, and would be naturally interpreted by any engineman used to permissive telegraph blocking, and the same can be said in regard to No. 12 and No. 6 above. In every case shown variations occur to distinguish between the different classes of signals, such variations consisting merely in the relative horizontal position of the arms and lights or in a distinguishing mark on the blade or an additional light. None of these affect the conduct of an engineman until after he has stopped, and therefore are of no importance to a train moving at speed. Surely these five aspects need not prove a burden to an engineman intelligent enough to comprehend the present signals found at an interlocking plant, with all their inherent inconsistencies.

If it is not safe to give advance information to an engineman, it seems to me we should abolish slow signals, whistle posts, station signs, distant signals for isolated interlocking plants, permissive blocking, and train orders, especially the "Form 19."

v. c.

In January last, work was commenced on the second section of the Longitudinal Railway, Chile, comprised between Oficina Granja, in the province of Tarapaca, and Pueblo Huido, in the province of Chanaral. The section referred to has a length of 450 miles, and the contract cost of construction is \$11,200,000.

STUDIES IN RAILWAY ECONOMICS.*

VI.

BY W. M. ACWORTH.

We have agreed that the railway customer is entitled to claim reasonable facilities as well as reasonable railway rates. What is a reasonable facility? With the alteration of a word or two the same definition will serve: "A reasonable facility is a facility which an expert manager would concede, or, as the case may be, would continue, having carefully considered all the relevant circumstances, and being actuated solely by judicial and avowable motives." In fact, reasonable facilities and reasonable rates are really the converse of each other. For it is evident that a rate for the carriage of perishables is only reasonable on the supposition that it connotes corresponding facilities. If the perishables were only given a service such as is adequate for coal, the rate would be most unreasonable. And facilities, like rates, must be reasonable from the point of view of the railway which gives them, as well as from that of the customer who requires them. It is questionable whether the courts, either in England or America, have sufficiently kept this point in view. Broadly speaking, the earnings of a new train are the best measure of its public utility; and when an English court orders a railway company—as it has done before now—to run a new train service, whose average earnings amount to 2d. per mile, the facility is hardly one that the company can be reasonably called on to give. Or, again, when an American state railway commission compels a through express to stop at the state capitol, we may well think that it has lost sight both of the reasonable rights of the railway and of the balance between the convenience of the few and the inconvenience of the many.

I feel, however, that between reasonable rates and reasonable facilities there is a real distinction. I have given in a previous article at some length reasons for thinking that no rate can be reasonable which in the long run does not at least pay out-of-pocket expenses, using that elastic term in a sufficiently wide sense. I do not think the same limitation can be applied to facilities. The broad general statement commonly made in the United States that passenger traffic does not pay undoubtedly contains a considerable element of truth. One can easily imagine that on the Northern Nigerian Railway passenger trains may not pay their working expenses for an indefinite number of years to come, and yet a refusal for this reason to furnish any passenger accommodation could hardly be justified. Some service must, I think, be given as a matter of public policy. And the loss on it must be borne out of the profits on the freight service, when profits there are, and, if not, by a subsidy from general taxation. Here is one of the points where, as it seems to me, the manager of a private undertaking, be he never so competent and never so honest, cannot expect to be allowed to decide for himself, and must be subjected to control by public authority. Of course, public authority must be expected to act with a due sense of responsibility. The interference of a reckless and irresponsible public authority condemns itself. To give one instance. The public in the western states of America have been accustomed to a standard of passenger accommodation unknown under similar circumstances in other countries. In spite of a report by their own expert officials, the state railway commission, that such accommodation could not reasonably be afforded for less than 2½ or 3 cents per mile, the legislature of the state of Wisconsin two or three years ago enacted a law that no railway fare in the state should exceed 2 cents a mile. The illustration is instructive as showing that, when we rise from the private manager to the public controlling authority, we do not necessarily obtain a higher standard either of competence or of impartiality.

The question, what is a reasonable rate or a reasonable facility, is difficult, but the question, what is an undue preference, is

*Previous articles appeared in these columns as follows: January 6, p. 10; January 13, p. 75; January 20, p. 114; January 27, p. 155; February 3, p. 200.

tenfold more difficult. The definition is easy enough. We may use our old formula: "An undue preference, is a preference which an expert manager, having carefully considered all the relevant circumstances, and being actuated solely by judicial and avowable motives, would not give." But the manager spends his whole life in giving preferences. Every time he reduces A's rates, or improves A's facilities, he prefers A to B and C, and all the other letters of the alphabet, whose circumstances have been left unaltered. When, then, does the preference become undue? It is clearly impossible to set out an answer in a legal formula. My own inclination would be towards an answer to the question in the abstract in some such terms as this: "No preference is undue which is honestly and deliberately given, after due consideration of all the conditions, for the sake of developing the traffic." And yet I feel that as a matter of practical politics no such doctrine could possibly be acted on to its full extent, except perhaps by a pioneer railway in a new country. Elsewhere the situation that has grown up over a long series of years would make the freedom theoretically desirable quite impossible in practice.

A relation of rates, *inter se*, that would be regarded in one country as natural and obvious, because the trade of the country has grown up under it, would be regarded in another country accustomed to an entirely different system, as impossible and revolutionary. This may be illustrated on two sides: the relation between the *quantum* of the rate per ton per mile, on the one hand, and the distance carried and the size of the consignment, respectively, on the other. Take first the question of distance. The trade of the United States has grown up under a system which ignores distance in a degree that to the ordinary Englishman seems not merely unjustifiable, but absolutely incomprehensible. Chicago is 1,000 miles east of Denver, and is distant from the great cities on the Atlantic seaboard somewhere between 800 and 1,200 miles. From the whole territory east of Chicago the rates to Denver are the same. A consignment from Boston, 2,200 miles, pays the same rate per ton as for the 1,200 miles, or thereabouts, from Indianapolis and Louisville. In other words, the ton-mile rate is in the one case practically half what it is in the second. Imagine an English railway company attempting to contend before our railway commission that such a practice did not amount to an undue preference of Boston over Louisville. Yet the whole trade of the country has grown up under this system, and fundamental modification off-hand is simply unthinkable. Or, again, take another American situation. In the South there has existed from the beginning what is known as the "basing point" system. Through rates are made from, say, the New England states to the principal towns, or basing points. Traffic for local stations pays the through rate from the point of origin to the nearest basing point, *plus* the local rate from that point to destination, irrespective of whether the destination be short of, or beyond the basing point. In other words, on rates say, from Boston into Georgia, a station 50 miles north of Atlanta never obtains any advantage of its geographical situation over a station 50 miles south of Atlanta, and therefore 100 miles further from Boston.

German practice is at the opposite pole from that of America, and the precise distance is an essential factor in almost every German rate. But, whereas, in most classes of the German tariff, the rate increases in simple arithmetical proportion as the distance increases, that is to say, the conveyance rate for 400 miles is 20 times the conveyance rate for 20 miles, in two classes, "specified small consignments," and "exceptional Class III, ten ton lots," the rates are on a sliding scale, that is to say, the rate per mile decreases as the mileage increases. It is difficult to imagine any justification on the ground of abstract reason for the simultaneous application of these two conflicting principles. But the trade of the country has grown up under them, and, of course, as the rates are part of the law of the land, they cannot be challenged in a law court in any specific instance. It is worth notice, however, as showing the importance of what I have termed the "acquired situation," that the attempt, some 20 years ago, to

apply the sliding scale rates (*Staffel Tarife*) to the carriage of grain roused such an outcry that even the autocratic Prussian railway administration had to bow before the storm.

France, again, has a system of its own. The normal rates on which the retail consignments are carried, are based on sliding scale mileage tariffs, but the great bulk of the trade is done on special rates (*prix fermes*), and a *prix ferme* is quoted as merely applicable from A to B. But there are two rules applicable to all such tariffs, known respectively as "Welding" (*Soudure*) and the "Intermediate Station Clause" (*Clause des Stations non-dénom-mées*), under which any station on the line of the special tariff can claim the benefit of it, and any station off the line can do the same on condition of paying in addition the local rate to the nearest station on the line.

In England contradictory practices prevail for the same traffic in different districts. For example, on shipment coal in South Wales each colliery pays a rate strictly proportional to its mileage distance, whereas in South Yorkshire the collieries are grouped. Grouping has been more than once upheld in the courts. Indeed, it is expressly declared by the Traffic Act of 1888 to be legal, "provided that the distance shall not be unreasonable, and that the grouped rates charged and the places grouped together shall not be such as to create an undue preference." Which, seeing that the real question is, what distance would be unreasonable, and what grouping would create an undue preference, may be interesting as showing the legislature's consciousness of its own limitations, but hardly helps towards a solution of the question. It is difficult, however, to imagine that, if the Taff Vale were now for the first time to attempt to group all the collieries in the Rhondda valley at an average rate, the colliery nearest to Cardiff would fail in an application for an injunction against undue preference. Or, take another instance, Southampton has grown into a great town as an outport of London, under a system by which goods consigned to or from ocean-going vessels are carried on a special classification at rates far below those normally charged in this country for similar goods over an equal distance. On the single occasion when this system was challenged before the court the applicants failed to upset it. Yet it is safe to say that no such system could come into existence nowadays for the first time. As for English rates in general, for merchandise traffic we may perhaps generalize somewhat as follows: Ordinary class rates are, but with innumerable exceptions, based pretty strictly on mileage according to the sliding scale laid down by the Provisional Orders of 1891-1892. Special rates, more particularly for higher class traffic and in districts where sea competition is not a controlling feature, tend roughly to conform to the statutory sliding scale. But in certain cases—for instance, rates on paper from Aberdeen—distance is frankly thrown overboard; while in other cases, as, for example, the fish rates from Scotland to London, there are groups as startlingly large, having regard to the small area of these islands, as the American groups mentioned above.

FOREIGN RAILWAY NOTES.

The construction of the Saigon-Batambang Railway, Indo-China, and its extension to the Siamese frontier where it will ultimately connect with an extension from Petriew is the subject of much favorable comment in the Siamese press. The cost of the Indo-China project will be covered out of the loan of \$20,000,000 projected by Governor General Klobukowski for public works. With the completion of the Indo-China, together with the Peninsular Railway all Malaysia will be put in touch with China by rail.

The Beira Junction Railway and the Mashonaland and Rhodesia Railways, South Africa, have decided to build a new deep-water wharf, extend the existing stage in the Chiveve creek and the railway freight sheds, and to purchase additional machinery, engines and rolling stock.

BALTIMORE & OHIO GRAVITY YARD AT CHICAGO JUNCTION, OHIO.

The Baltimore & Ohio is completing the construction of a large gravity yard of 4,000 cars' capacity at Chicago Junction, Ohio, 278 miles east of Chicago, where lines converge from four different directions. At this point eastbound business is divided between the line going directly east through Pittsburgh and that turning southeast through Newark and Wheeling, to a connection with the main line again at Cumberland, Md. All westbound business from Chicago Junction is concentrated on the one line to Chicago. A branch also extends north to Sandusky. Double track is in operation from Chicago Junction east to Pittsburgh and west, a distance of 69 miles, to Hamler, Ohio, while the line south to Newark is single track.

Owing to the dividing of the eastbound traffic and a change in tonnage at this point, it is necessary to break up practically all trains, and the yard is planned so that a maximum amount of switching may be done here and the trains go through suc-

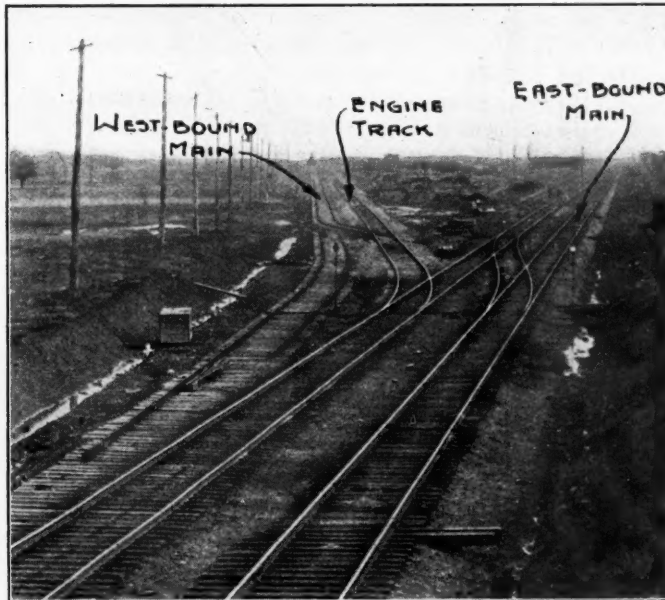
and extends west about 2½ miles along the north side of the present Chicago main line. The site of the yard was rolling, and rather rough farm land with numerous hills and ravines. For this reason the earthwork was heavy, totaling about 1,000,000 yds. All grading was done by contract, and the material was secured from three borrow pits, one of them being across the main line from the yard on the site of a new reservoir. From this latter pit 300,000 yds. were removed, a large part being below the adopted flow line of the reservoir and materially increasing its capacity. The contractor's equipment used on this work consisted of three 60-ton Marion steam shovels with three yard side dump cars and narrow edge dinkey engines. The grading was started in March, 1910, and completed within eight months, working both day and night



Shop and Supply Buildings at Repair Yard.

ceeding yards with very little breaking up. The facilities at this point have been very badly congested for a number of years. The old eastbound yard had a capacity of about 700 cars, and was situated a short distance west of the coal chute and round house at an angle with the present yard, while the westbound yard was located south of the depot on the Newark branch. No change was made in the engine house, shops or coal chute, as they were built but 5 years ago and were located with the proposed yard in view.

The new yard starts immediately west of the round house



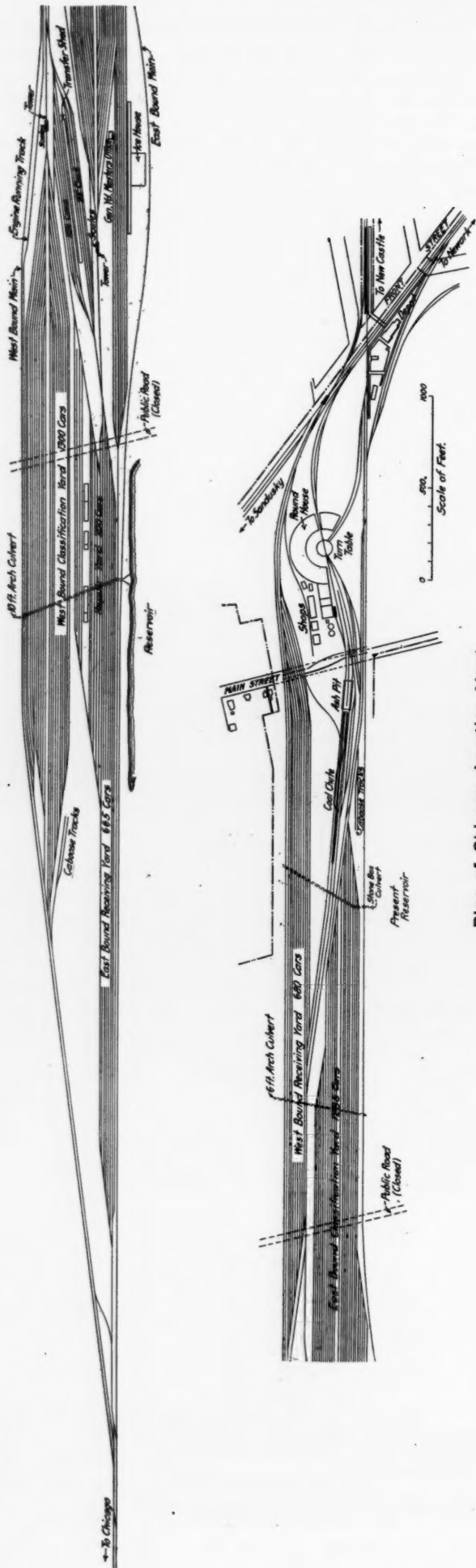
Looking East at West End of Yard During Construction.

shifts. Almost the entire yard was built on a fill, one track being raised to grade and the material unloaded and spread out from this except in cases of the higher fills, where trestles were built across the ravines for the first track. In some cases the fills reached 32 ft. in height.

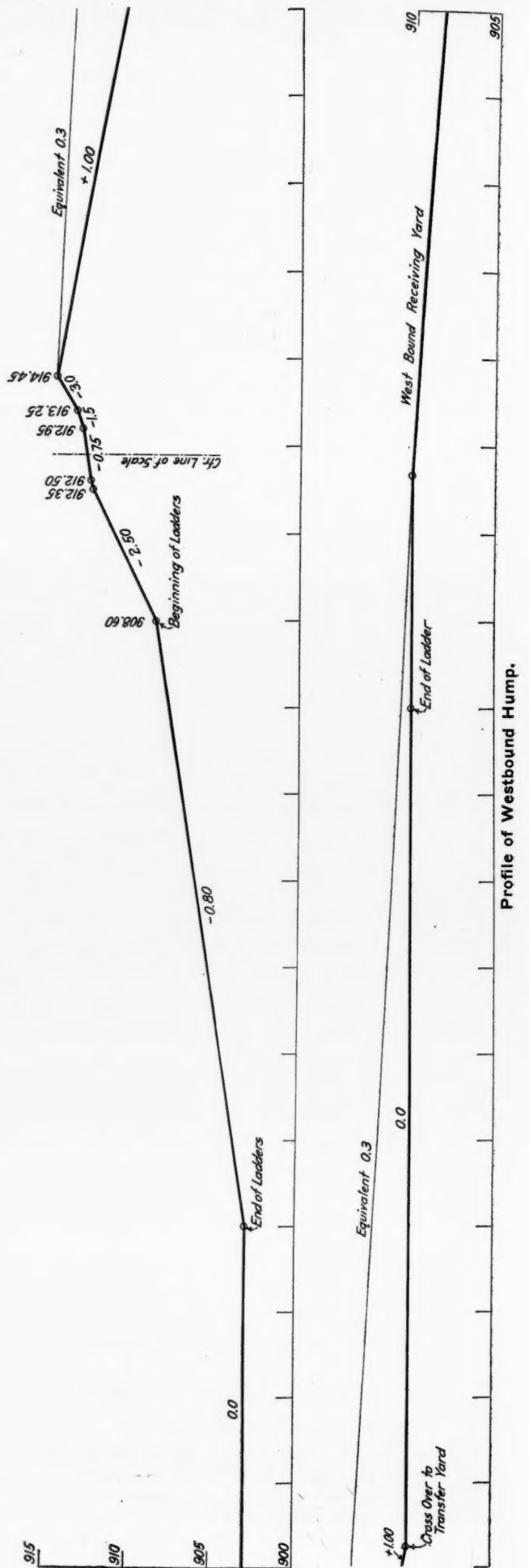
Preliminary to the starting of the grading arrangements were made with the highway commissioners for the permanent closing of two highways which had formerly crossed the site of the yard. Main street had been carried under the tracks of the old yard through a concrete subway of 20 ft. span, 165 ft. long.



Westbound Hump, with Tower and Scale House.



Plan of Chicago Junction Yard.



Profile of Westbound Hump.

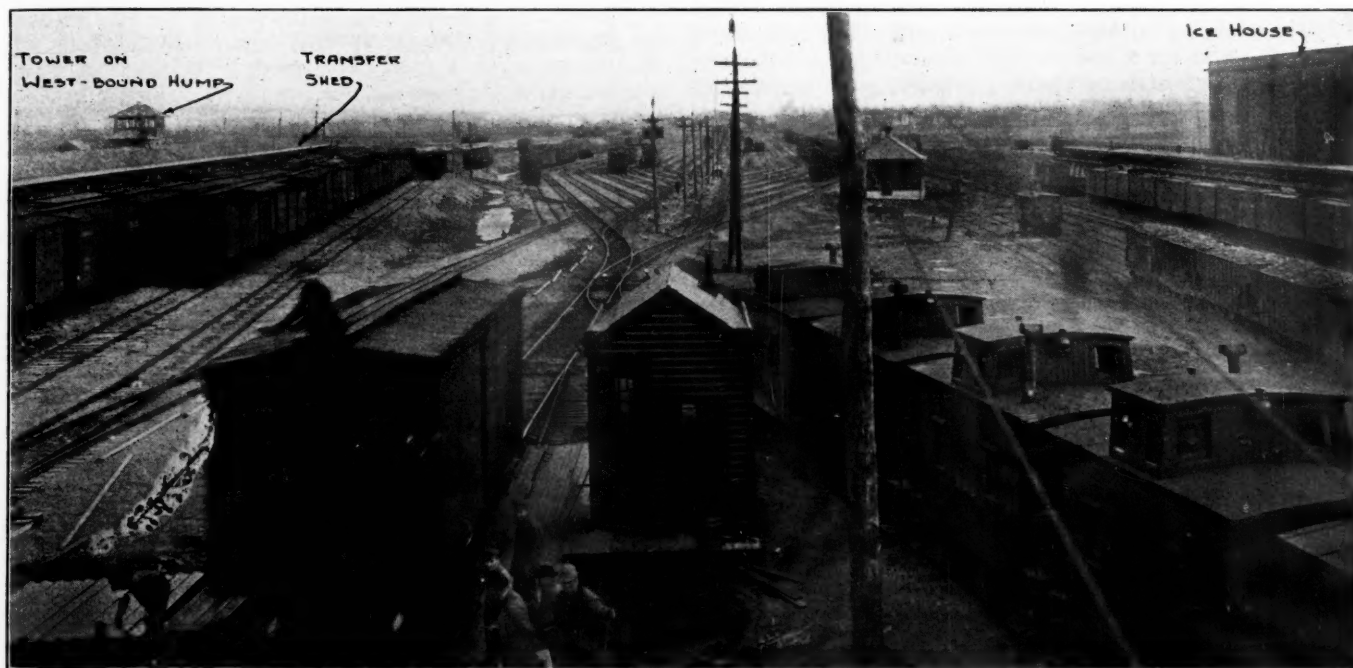
In connection with the new construction the roof of this subway had to be rebuilt. The old masonry walls were used, but the old girders with the wooden deck were replaced by 18-in. I beams embedded in concrete. A 6-ft. arch, a 10-ft. arch, and a 3 ft. by 5 ft. rail top culvert were also built in draws to provide for the natural drainage.

The westbound receiving yard starts immediately west of the round house and is entered directly from the Newark-Sandusky line or from the Pittsburgh line through the Y and a slip switch across the Sandusky line. This receiving yard is composed of eight tracks, averaging 65 cars capacity each, and is built on an equivalent of 0.3 per cent. grade extending to the hump, this equivalent grade formed by alternate level and steeper grades being inserted to reduce the earthwork quantities. On the other side of the hump there is 40 ft. of 3 per cent. grade followed by 20 ft. of 1.5 per cent., and then 60 ft. of .75 per cent. across the scales. Beyond this there is 160 ft. of 2.5 per cent. grade to the first switch dividing the ladders, and then an 8 per cent. grade extending through the ladders. From this point the grade is level through the classification yard, which consists of 20 tracks leading from two ladders, with

between the two main lines, and there will be no occasion for crossing the main lines. A small change will be made in the eastbound main line at the ice house, where the track will be thrown behind it to provide room for a Q. D. or time freight yard.

A transfer shed for the transfer of l. c. l. freight 800 ft. long by 24 ft. wide, with four tracks on each side, is located midway between the two classification yards and equally accessible from each yard. This shed is mounted on concrete piles, and consists of a covered platform with the exception of an office at the east end, and a storage room 43 ft. long at the west end for hold-over freight. About 125 cars of this l. c. l. freight are handled daily, being brought here from all directions and cars are loaded for all the larger terminals without further transfer.

The repair yard is located between the westbound classification yard and the eastbound receiving yard, and is provided with eight tracks having a capacity of about 200 cars, together with the necessary material sheds and work shops. It can also be reached directly from both the eastbound and the westbound yards.



Eastbound Classification Yard from Tower.

capacities varying from 50 to 75 cars, and averaging 65 cars. The north 10 tracks are further divided at the west end between two ladders connecting five tracks each. This yard leads directly out on to the engine running track and from that to the main line. This engine running track extends from the round house entirely around the yard on the north, providing an independent lead for the engines in going to and from the yard. This yard is somewhat unusual in that no departure yard was provided, but the road engines pull their trains directly from this classification yard. At the west end of the classification yard are two caboose tracks built on a slight grade so that way cars can be dropped down on to a train as it is pulling out of the yard. The arrangement of the eastbound yard is practically the same as that just described for the westbound yard with the directions reversed. The receiving yard is composed of seven 95-car tracks providing for the longer trains from the west, and giving practically the same capacity as the westbound yard. A new roadbed has been graded for the westbound main line around the yard on the north parallel to the engine running track, and as soon as the yard is put into operation this track will also go into service and the old westbound main track taken up. In this way the yard is located

All tracks and ladders are laid with second hand 85-lb. rail throughout the yard, while 90-lb. rail was laid on the main tracks. Untreated ties, principally cedar and chestnut, were used, and tie plates were placed on all except oak ties. For the first raise of ballast cinders were used, but the second raise was made on granulated slag. This was of especial advantage during the winter, for in most cases it was still warm when unloaded and could be worked on the track when other material was frozen, enabling the surfacing to continue during the cold weather. All track work and ballasting has been done by company forces and an average of about 260 men has been employed. No. 8 turnouts were used in all cases, except in main line, where No. 10, 16 and 20 turnouts were installed. All ladders were laid to No. 8 angles and hard center frogs were used at the junction of ladders or wherever the traffic was heavy. Rail anchors were placed on the hump to prevent the track from creeping on to the scale. Tracks in the yard were laid to 12-ft. centers with 14 ft. between the engine track and adjacent ladders and 13 ft. between the engine track and the main track. A 50-ft. 150-ton Fairbanks-Morse automatic scale, with scale house, was installed on concrete foundation at each hump. The scale pit is entirely of concrete and access to it is

gained from the side. The entire pit is easily accessible for inspection and repair work and is brightly lighted by electric lights.

Three complete interlocking towers, with electro-pneumatic push button machines, are being installed. The machine will be located at the west end of the yard to handle movements in and out. The other machines will be installed at the two humps and will handle the switches leading to the classification yards. Air for these machines and for the repair yard will be supplied through a 3-in. pipe line leading from a compressor in the power plant near the round house. A large amount of attention has been given to furnishing office facilities and conveniences for the employees of the yard. Individual steel lockers are installed for all employees, those for the switchmen, yard clerks and tower men being placed on the first floor of the towers, while those for employees in the repair yard are placed in the repair yard office. All buildings are heated by steam from a central plant in the general yardmaster's office building, except the repair yard buildings, which are heated from a separate plant. All buildings are lighted by electricity furnished from a power plant near the round house. The different machines in the repair yard are operated by power from the same source. Electric arc lights on high poles are also installed at intervals of 360 ft. along the ladders leading from the humps. A complete telephone system is installed connecting all offices. An elaborate system of fire protection has been provided, plugs being placed throughout the yard at intervals of about 600 ft. The transfer shed is protected by eight plugs below the platform. A drainage system embracing about nine miles of sewers, with trunk lines along each ladder, is planned and will be built this season.

A reservoir of 110,000,000 gals. capacity was built just south of the main track and opposite the 10-ft. arch culvert by the construction of a concrete dam and spillway across the neck of the small ravine. A small area between the dam and the culvert is paved with concrete to prevent seepage and wash. This reservoir will act as a reserve for the main reservoir near the round house, where the supply frequently is insufficient to meet the daily demands which average about 500,000 gals. It is connected with the main reservoir by a 10-in. gravity equalizing line. This new reservoir will also provide water directly for fire protection, for a pump and concrete tank will be installed near the center of the yards to furnish water for this purpose and for the hump engines.

Due to the congestion last fall the eastbound yard was rushed to completion and put into service last November. The westbound yard is now practically complete and will go into service in a short time. The Q. D. or time freight yard will be built this summer as soon as the main line is thrown back of the ice house.

The contractor for the grading and masonry was the Robert Grace Construction Company, Cleveland, Ohio. All building work, together with the laying of the 10-in. pipe line, was contracted by P. Farrell, Cincinnati, Ohio, and Hoffman & Conklin, Columbus, Ohio, were contractors for the air line. This work was designed and built under the direction of A. W. Thompson, then chief engineer, and F. L. Stuart, chief engineer, by L. G. Curtis, engineer maintenance of way, F. E. Toenniges, assistant engineer, and C. G. Kistler, resident engineer in charge, to whom we are indebted for this information.

The government of Ecuador is pushing the work of construction on the Manta to Santa Ana Railway, inasmuch as the section of the country which it traverses will benefit by railway communication with a Pacific coast port. The extension and completion of the line will doubtless mean increased prosperity to the inhabitants of the zones through which it will pass and insure a more rapid exploitation and development of the immense natural resources of this highly productive region of the republic.

STANDARD OIL COMPANY ORDERED DISSOLVED.

The United States Supreme Court, by a unanimous decision, on May 15 declared the Standard Oil Company to be a combination in restraint of trade, and therefore a violation of the anti-trust law, of 1890; and ordered its dissolution within six months. The decision applies to the Standard Oil Company of New Jersey and 33 subordinate corporations, with an aggregate capital of \$110,000,000. The opinion was delivered by Chief Justice White. Justice Harlan concurred in the decision, but dissented from the conclusion of the majority that restraint of trade must be shown to be undue in order to be held unlawful.

Counsel for the oil company claimed that the acts of the company which gave it such great advantages over all competitors were only the result of lawful competitive methods, guided by economic genius, courage and commercial insight. The court rejects this view and says that it is impossible to avoid the conclusion that there was constantly an intent and purpose not only to develop the oil business, but to exclude other persons from a part in it. The methods employed were such as necessarily involved the intent to drive others from the field. To the argument that dissolution of the company and its subsidiaries would work great injury to property, the court replies that the stockholders are not restrained from making normal and lawful contracts. Discussing the question whether the Sherman law prohibits all combinations in restraint of interstate trade, Chief Justice White reviews his study of the common law and the law of the country at the time the Sherman law was passed (1890) and says:

a. That the context manifests that the statute was drawn in the light of the existing practical conception of the law of restraint of trade, because it groups as within that class not only contracts which were in restraint of trade in the subjective sense, but all contracts or acts which theoretically were attempts to monopolize, yet which in practice had come to be considered as in restraint of trade in a broad sense.

b. That in view of the many forms of contracts and combinations which were being evolved from existing economic conditions, it was deemed essential by an all-embracing enumeration to make sure that no form of contract or combination by which an undue restraint of interstate or foreign commerce was brought about could save such restraint from condemnation. The statute under this view evidenced the intent not to restrain the right to make and enforce contracts, whether resulting from combination or otherwise, which did not unduly restrain interstate or foreign commerce, but to protect that commerce from being restrained by methods, whether old or new, which would constitute an interference that is an undue restraint.

c. And as the contracts or acts embraced in the provision were not expressly defined, since the enumeration addressed itself simply to classes of acts, those classes being broad enough to embrace every conceivable contract or combination which could be made concerning trade or commerce or the subjects of such commerce, and thus caused by any act done by any of the enumerated methods anywhere in the whole field of human activity to be illegal if in restraint of trade, *it inevitably follows that the provision necessarily called for the exercise of judgment which required that some standard should be resorted to for the purpose of determining whether the prohibitions contained in the statute had or had not in any given case been violated. Thus, not specifying, but indubitably contemplating and requiring, a standard, it follows that it was intended that the standard of reason which has been applied at the common law and in this country in dealing with subjects of the character embraced by the statute was intended to be the measure used for the purpose of determining whether in a given case a particular act had or had not brought about the wrong against which the statute provided.*

And the second section was designed to supplement and re-

inforce the first. And it becomes obvious that the criteria to be resorted to in any given case for the purpose of ascertaining whether violations of the section have been committed is the rule of reason, guided by the established law and by the plain duty to enforce the prohibition of the act, and thus the public policy which its restrictions were obviously enacted to subserve.

As the restraints of trade to which the first section applies is not specifically enumerated or defined, it is obvious that judgment must in every case be called into play in order to determine whether a particular act is embraced within the statutory classes, and whether, if the act is within such classes, its nature or effect causes it to be a restraint of trade within the intendment of the act.

To hold to the contrary would require the conclusion either that every contract, act or combination of any kind or nature, whether it operated a restraint on trade or not, was within the statute, and thus the statute would be destructive of all right to contract or agree or combine in any respect whatever as to subjects embraced in interstate trade or commerce; or, if this conclusion were not reached, then the contention would require it to be held that as the statute did not define the things to which it related and excluded resort to the only means by which the acts to which it relates could be ascertained—the light of reason—the enforcement of the statute was impossible because of its uncertainty.

Chief Justice White, referring to the opinion of the Supreme Court in the cases of the United States agt. Trans-Missouri Freight Association and United States agt. Joint Traffic Association, declared that the general language of those opinions had been subsequently explained and held not to justify the broad significance attributed to them.

"And in order not to in the slightest degree to be wanting in frankness," said the Chief Justice, "we say that in so far, however, as by separating the general language used in the opinions in the Freight Association and Joint Traffic cases from the context and the subject and parties with which the cases were concerned, it may be conceived that the language referred to conflicts with the construction which we give the statute, they are necessarily now limited and qualified. We see no possible escape from this conclusion, if we are to adhere to the many cases decided in this court in which the anti-trust law has been applied and enforced, and if the duty to apply and enforce that law in the future is to continue to exist. The first is true, because the construction which we now give the statute does not in the slightest degree conflict with a single previous case decided concerning the anti-trust law, aside from the contention as to the Freight Association and Joint Traffic cases, and because every one of those cases applied the rule of reason for the purpose of determining whether the subject before the court was within the statute. The second is also true, since, as we have already pointed out, unaided by the light of reason, it is impossible to understand how the statute may in the future be enforced and the public policy which it establishes be made efficacious."

It was claimed that as the Standard Oil Company controlled but a small percentage of the crude oil produced, it was not a monopoly; but, says the court, the company's complete control over the refined product gave it substantial power over the crude product.

The sixth section of the decree of the lower court forbade the formation by the subsidiary corporations, or other stockholders, of like combinations. The Chief Justice says that this should not be taken as depriving the stockholder or the corporation of the right to exist under the law. For example, if two of these corporations, controlling pipe lines, should combine so as to make a continuous line, such a combination would not be repugnant to the act. In the same way, the Union Tank Line must be left free to distribute tank cars among the subsidiary corporations, as the public interest may require.

Mr. Justice Harlan in his dissenting opinion, says:

The men in Congress who framed and passed this law knew what they wanted to do and how to do it. They knew the common law with respect to restraint of trade. Ever since 1897 attempts have been made in Congress to modify the Sherman law so as to make it prohibit unreasonable restraint of trade instead of prohibiting plain restraint of trade, but these attempts have all failed. The language of the statute is clear and the court in the present decision, by modifying it to the extent of giving power to the courts to decide what is and what is not prohibited by the law is in effect amending the constitution. The judiciary thus invades the authority of the legislative branch of the government.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.

The third annual convention of the International Railway Fuel Association was held at the Hotel Patten, Chattanooga, Tenn., May 15-18. W. C. Hayes, president of the association and superintendent of locomotive operation of the Erie, presided. In his presidential address Mr. Hayes favored the organization of a fuel department on each railway, to handle the purchasing and distribution of fuel and questions arising in connection with its economical use. This department should co-operate with the operating and mechanical departments. He urged the association to become interested in and support legislation which would make arbitration of disputes between mine owners and employees compulsory.

T. C. Powell, vice-president of the Southern Railway and the Queen & Crescent, said that operating conditions of the present demand that more attention be given to coal supply, distribution, quality and utilization than ever before. An example of the latter is found in the public interest in the effect of coal burning on cleanliness. Coal burning in England is done with much greater cleanliness than in this country on account of efforts to suppress smoke by the design of engines, inspection and proper firing. Mr. Powell spoke of the opportunities of the association in the intensive use of fuel, and suggested the compilation of a manual of recommended practice to govern its handling and use.

The secretary's report showed a gain in the number of members of 118, making the total membership 367.

FUEL INVESTIGATIONS BY THE GOVERNMENT.

In the absence of Dr. J. A. Holmes, director of the Bureau of Mines, the paper on the fuel investigations conducted by the Bureau, which he had prepared, was read by S. B. Flagg, engineer of the Bureau. The paper reviewed the work of the government coal-testing plant since its creation in 1904, commended the now quite general practice of buying fuel by specification and treated of various methods of testing, and of the use of briquetted fuel in locomotives. Of the latter the following was said:

A series of experiments were conducted at the locomotive-testing plant of the Pennsylvania at Altoona, Pa., in which the Geological Survey actively co-operated. All the fuel used was inspected by the Survey at the time shipment was made, a portion of it going to the testing plant in St. Louis to be briquetted, and being then forwarded to Altoona for the test. The conclusions drawn from these tests show that, although the evaporation per pound of briquets was greater than it was per pound of raw coal, and the amount of smoke made was less with briquets, the increased cost of the briquetted fuel was not warranted by the resulting increase in evaporation efficiency.

Another series of comparative trials of run-of-mine and briquetted coal in a locomotive boiler was conducted jointly by the Seaboard Air Line and the representatives of the Survey in the company's yards at Portsmouth, Va. Bulletin 412 of the Geological Survey describes the method of conducting the tests and gives the results. The comparative showing made by the

raw coal and the briquets, under the conditions there obtaining, was somewhat more in favor of the briquets than it was in the other tests mentioned. Among the conclusions drawn were the following: (a) At low rates of working, run-of-mine coal gives a higher equivalent evaporation than briquets; at medium rates there is little difference, at high rates briquets do considerably better; (b) the smaller briquets are easier to fire and to level on the fire than are the larger ones. Either form gives the fireman far less work and trouble than run-of-mine coal; (c) in sparks briquet fires lose less than coal fires; (d) on roads having heavy grades it will probably pay well to burn briquets, at least part of the time; (e) perhaps it would pay to add combustion chambers to the front ends of some locomotive fire boxes, and use a larger number of boiler tubes of shorter length and smaller diameters.

Most of the later briquetting tests have been made on the low-grade fuels, of which there are immense deposits in some parts of this country. In some localities the deposits of these sub-bituminous or lignite coals have remained practically undeveloped because of the fact that there was only a small local demand, and the fuel in its raw state could not be shipped to any distant points because of the slacking or disintegrating action of the air. By partially drying these coals and then subjecting the material to heavy pressure in an open-mold-type press it has been found possible to make from some of them, without the use of any binding material, briquets which could be handled without excessive breakage and which also withstood the action of the weather reasonably well.

The paper also referred to locomotive smoke prevention as follows:

The abatement of locomotive smoke is one of the most difficult problems with which a city smoke inspector has to contend, and yet in many of our cities where efforts are being made to improve conditions, the amount of locomotive smoke has been greatly reduced. In such places the railways have made some changes in their equipment, and in addition to this have put on their own inspectors, whose duties are not only to watch for and report firemen who are violating the ordinance, but also to instruct such men as to methods of firing by which the smoke may be prevented or greatly reduced. The entire elimination of locomotive smoke does not today appear to be a possibility in sections where a high volatile coal is used. At least, it will not come without some decided changes in locomotive design. But it can safely be stated that there is no locality where the present conditions cannot be improved upon.

Discussion.—In the discussion of Dr. Holmes' paper it was brought out that obedience to the rules on the part of the firemen is essential to and an important consideration in the proper burning of coal and the prevention of smoke. Eugene McAuliffe, general fuel agent of the St. Louis & San Francisco, discussing fuel testing, as affecting smoke, said that the best results would be obtained if the technical questions involved in getting the maximum efficiency out of coal, as well as the economical questions of inspection and handling, were put in the hands of a fuel engineer, specially trained.

George M. Carpenter, chief fuel inspector, Nashville, Chattanooga & St. Louis, referring to smoke prevention, described some tests with a locomotive designed by F. F. Gaines, superintendent of motive power, Central of Georgia. The tests showed no smoke during 95 per cent. of the time the tests were conducted.

ORGANIZATION OF A RAILWAY FUEL DEPARTMENT.

T. Duff Smith, fuel agent, Grand Trunk Pacific, presented the following paper on How to Organize a Railway Fuel Department and Its Relations to Other Departments:

When we consider that at least 8 per cent. of the earnings of our railways is spent on fuel, it is plain that it requires expert management and should be under the control of a department which should have proper recognition. The fuel department should consist of the fuel agent, his clerical staff and fuel in-

spectors, and also in cases where the railway owns and operates its own coal dock, a dock superintendent and his staff.

I do not believe in keeping the accounting separate from the purchasing and distributing parts of the work but think that the fuel agent should be held responsible for all fuel from the time it is purchased until it is finally accounted for to the audit department. There is a great difference of opinion as to *who* should purchase fuel. My own opinion is that it should be done by the fuel agent, under the direction of the general manager or general purchasing agent.

The fuel agent should have a thorough knowledge of the different qualities and grades of coal on his own line and adjacent thereto, and should keep in close touch with all movement in the way of development thereon. He should also study the geological formation of all districts adjoining his line so that he may know where to look for future supplies. To insure economical working he should be familiar with the capabilities of the different classes of bituminous coal; also hard, slack and lignites, by the use of which he may greatly reduce the cost of heating round houses, stations, etc. The distribution of coal should be closely watched so as to prevent congestion and avoid extra haulage. The actual office work of issuing orders for distribution and also tracing cars which have not reached their destination in reasonable time should be assigned to one of the office staff, a fuel distributor.

The fuel agent should not spend too much time in the office where the routine work can be attended to by the clerical staff, but should be out on the line as much as possible, getting in close touch with the men who have the actual handling, master mechanics, road foremen, agents, etc., and thus gain information which will enable him to make economies. He should have a knowledge of the different systems of handling coal so as to be able to meet any contingencies and to keep the actual cost of handling at a minimum; and he should so arrange his supplies that while amply protecting himself against any possible shortage by reason of unforeseen delays, bad weather, wrecks, wash-outs, etc., he may not have too much stock on dumps, thus causing extra cost by shrinkage, double handling and interest on money lying idle.

He should have an all round knowledge of the accounting system, and have such reports sent in as will keep him in close touch with actual stocks and costs. The system of records should be such that it is absolutely impossible for any car or any fuel to remain unaccounted for. The actual charging for the fuel and distribution of charges should be done by the fuel accountant, who is on the fuel agent's staff.

He should keep in close touch with the general manager, purchasing agent or other officer to whom he directly reports, so that he may have immediate advice on questions of policy, etc., and with general superintendents so that they may facilitate movement of cars, and also to get advance notice of any extra supplies required by reason of rush of traffic, opening pits or track laying. He should consult them as to any alterations required to improve coaling tracks or plants, especially at temporary coaling stations.

He should also have daily communication with the car service agent so that a proper supply of equipment may be available at points required. On some lines, as on my own, we have a heavy westbound movement during the early part of the navigation season and a heavy eastbound movement during the fall months. Having to bring in our coal supply over the Great Lakes during navigation, it is most essential to keep well posted as to the car situation so that we may load all cars west with coal and save light cars (in our case we have to use all box cars), and so make traffic both ways, thus saving equipment and power. This same principle will apply to all local conditions.

But the most important official to the fuel agent is the superintendent of motive power or master mechanic. Fully 90 per cent. of our fuel is used by this department and it is only by the close co-operation of the two departments that the best results may be obtained. On a few roads they have a properly organized testing department, but with the majority tests have to be made by the mechanical departments, so that, to a great

extent, the fuel agent has to rely on the result of their labors. Also where a performance sheet is compiled, it will not be possible to get any improved performances unless the two departments work closely together. I am not in favor of the "pooling" system, as under it you cannot place the blame on the actual man who is wasting or burning too much fuel.

The last man, but far from the least, on the fuel staff, is the fuel inspector. To fill this position I prefer a practical miner to any one else. He should be competent to judge whether the coal is up to the standard required by contract. His duties are, to see that all cars before loading, are clean and in fit condition to carry coal, so that there will be no loss by leakage, and to see that all cars are weighed both empty and loaded, noting any differences between actual and stenciled tare. He should also inspect all coal loaded, which should be done at the picking table where he can see and detect impurities.

He should report daily, by mail if within one day's journey, otherwise by code wire, all cars loaded giving car numbers, weights and destination, also reporting any local conditions at the mine, such as variations in quality, opening new seams, car supply and labor conditions, especially when there is any friction between operators and employees, thus giving the fuel agent an opportunity to protect his stocks against any shortage caused by a possible strike or lock-out.

As far as consistent, he should confer with operators when they have trouble with bad veins, etc., and try by practical advice to help improve matters. I have been receiving coal from one mine where, by our inspector's practical advice, the quality has improved fully 20 per cent. during the last six months. Operators, instead of objecting to such inspectors, are pleased to have them. Inspectors should have the power to refuse absolutely any coal not up to standard, and having given your inspector this power, trust him, and stand behind him and you will soon find that operators will tender you only the article you have purchased.

Discussion.—The discussion of Mr. Smith's paper developed the fact that the Rock Island has a well-organized fuel department in charge of the purchase, inspection, and distribution of company fuel. Regarding this, D. B. Sebastian, fuel agent of that road, and secretary of the Association, said:

All contracts are made by the fuel agent who reports to the vice-president in charge of purchases, and the former is held responsible for economical distribution and contract grade and quality of coal when placed on locomotives. Fuel economy on our lines is under the special direction of the assistant general superintendent of motive power. He and the fuel agent work together in all matters pertaining to the grade of fuel to be used for various purposes. Slack coal, or screenings, is generally used at stationary plants and pumping stations, and other plants are being converted to slack burners also.

A fuel agent should have an intimate knowledge of all coal on his own line or vicinity. We are studying conditions carefully in that direction and keep on file complete drawings showing the character and geological formation of every vein from which we take coal. Our company makes an analysis of coal from technical samples taken from all mines periodically, with the object of eliminating, whenever practicable, those coals which run too high in non-combustible matter. In addition, they give us valuable information as to the number of heat units purchased.

The matter of distribution on the Rock Island is perhaps more important than on some other roads, as over 50 per cent. of the company coal is mined on foreign lines, and with the daily consumption running from 250 to 300 cars, it requires careful and constant attention. A practical miner makes a good inspector, if you have enough of them to cover the ground. However, the man with locomotive experience makes a desirable inspector and is a valuable asset to the fuel department. With authority to ride engines he can get right to the seat of the trouble when any complaint is made about poor coal. He can also deal satisfactorily with road foremen, master mechanics and others, when going to and from the mines.

We are buying coal from about 90 mines, and have five inspectors, including a chief fuel inspector, to cover the ground in 10 states loading company coal. We have lately instituted a chute foreman's condition report, and are trying, by education, to make fuel inspectors out of these men. The report includes a 24-hour performance, showing cars unloaded, with initial and way-bill reference, grade of coal and blank columns for chute foreman's estimate of quality, per cent. and kind of impurities, and condition of car as to containing refuse when unloaded. These reports are sent in daily from over 100 coaling stations and are checked carefully for any irregularities, which are immediately taken up for collection. In this way the Rock Island is endeavoring to inspect every car of coal, at the chute, if not at the mine, and we hope before long to have this system perfected to a point where it will be impossible for a car of inferior coal to be unloaded at one of our coaling stations.

Mr. McAuliffe said that the Frisco was the first to establish a fuel department. He believed that fuel economy is largely a matter of education and favored the conducting of continuous tests during the summer months, to determine the quality and effect of the fuel used.

The Missouri Pacific has a foreman's report similar to that on the Rock Island. The Michigan Central does not believe in centralizing the various operations connected with fuel, and so separates the purchasing, accounting and distribution, handling these in three different departments. J. T. Clark, traveling inspector, Southern Pacific, thought that if performance sheets were improved better results could be secured from enginemen, as the standards of comparison of the fuel used by them are not now so arranged as to show actual results.

PURCHASING COAL ON A MINE-RUN BASIS.

The meeting on Tuesday, May 16, opened with the reading of a paper on Some Results of Purchasing Coal on a Mine-Run Basis, by Prof. A. A. Steel of the University of Arkansas, of which the following is an abstract:

Even before the mining methods had changed, the industrial development of the country provided some sort of a market for the slack coal. As soon as slack coal became a marketable commodity, the costs of mining coal and the statistics of the output came to be figured upon a mine-run basis, without regard to size. Coal was also occasionally sold to the consumers upon a mine-run basis. In filling such orders it was not necessary to screen the coal, but in order to avoid this screening, it was necessary to agree upon a mine-run scale of payment to the miners.

As long as the payment to the miners was not directly affected by the weight of slack coal they produced, any increase in proportion of slack obtained from them caused an apparent reduction in the cost of producing coal per ton of mine-run. As a result, those superintendents of mines, whose work was judged only by the cost at which they could get out a ton of mine-run coal, were led to increase the percentage of slack as much as possible. Some even went so far as to neglect or alter the screens over which the coal was passed until an undue proportion of the miners' coal fell through it. This stealing of coal from the miners and the fact that slack was generally of value to the operators, caused the miners to demand direct payment for all sizes of coal they produced.

The miners secured the passage of laws prohibiting the screened coal basis of payment in many of the interior states. Some of the more recent of these laws, such as those of Kansas, Arkansas and Oklahoma, not only require equal payment for all sizes of coal but also compel the operators and, therefore, the railways to pay full price for the slate a careless miner sees fit to mix with the coal.

The mine-run basis of payment to the miners led to such an increase in the use of powder that the firing of shots caused frequent dust explosions. To avoid this danger to themselves, the coal shooters have secured the employment of shot-firers, who get sufficient pay to tempt them to run the risk. The only

thing which now induces the more careless miners to save powder is its cost. Unfortunately this is not very effective because the miners are learning to blow the coal to pieces in a still more convenient way by dislodging more coal with each shot than formerly. Heavy shots so jar the tight mass of coal that it becomes little more than a heap of slack.

The careless shooting of coal that has followed the continued payment of the miners upon a mine-run basis obviously injures the operators. But we are more interested in the consumers, because the fuel departments of the railways are the great consumers of coal. The consumers most directly suffer as a result of the poor quality of the output. Many of you are quite familiar with the so-called coal produced in the mine-run states where machines are not used for mining. You know that the remaining lump coal is so shattered that it becomes largely slack by the time you get it into a locomotive tender. You also know how anxious the operators are to sell you mine-run coal, or at least a modified mine-run. Some of you may have felt the additional pressure in favor of mine-run coal, which has been brought to bear by your traffic department, which does not wish to see the mines go out of business. As a result of buying mine-run coal, you are also familiar with the great increase in the per cent. of slack in the mine-run coal and know how much slack remains in coal from which 25 per cent. of slack has been removed.

Getting coal from other states throws business to competing roads and increases the cost of fuel. It causes other indirect injuries to the railway, such as the loss of traffic of the mines that cease operating when the fuel is purchased elsewhere. This in turn reduces the competition for railway fuel business, requires more inspection and forces the fuel agents to accept a lower grade of coal containing a larger proportion of slack.

The closing of the little mines causes a greater hardship to the railway during the regular biennial suspension of mining, because at such times the only regular supply comes from the smaller mines that have signed up with the union. The lack of discipline and the constant quarreling between operators and miners has been largely increased by the troubles caused by this mine-run basis of payment. One of the results of this is a greater frequency of petty strikes and the resulting annoyance to the railway fuel agents. It also insures a strike at the end of each biennial contract period.

The actual results of these mine-run laws depend upon local conditions. The Arkansas coal operator and the railways dependent upon them for fuel suffer more than the average. Some of the reasons are that this coal has unusually good heating value, low ash and freedom from smoke so that it should be an exceptionally fine engine fuel. It is, however, very tender and suffers especially from the heavy shooting. At nearly all the mines there is, in the coal next to it, a layer of very soft dirt, which is easily shot into pieces small enough to escape the slate inspector, so the miner can not be penalized for selling it to the operator. The operator passes as much of the slate as possible on the railway. Moreover, the miners of Arkansas have so far prevented the successful use of mining machines.

On the basis of the small normal output of coal in Arkansas, of only 2,500,000 tons a year, the losses caused by the mine-run law add up to \$4,250,000 a year, not counting the loss to railways and merchants caused by the decline of coal mining business of this state. It is a little difficult to separate the losses affecting either the operator or the consumer. Together these amount to \$1,670,500 a year net, and the loss to the consumer must be at least two-thirds of this, or, say, \$1,000,000. Since most of the Arkansas coal is sold to the railways your loss must be over half a million dollars a year. During 1910, practically no coal was mined in Arkansas for five months and during the fall the supply was poor, irregular, and high-priced. The cost of that strike to the railways was very much more than half a million dollars.

The only way to be sure of a good quality of coal is to buy it from the miner upon a lump coal basis or at least to pay

more for lump coal than for slack. In order to do this, the mine-run laws must be repealed.

So long as the operators have to buy coal from the union on a mine-run basis, they naturally wish to sell it upon the same basis. The good natural railways of the interior have also established the feeling that they should assist the operator as much as possible to struggle through hard times. Just at present the greatest burden the Arkansas operators have to bear is the excessive amount of dirty slack they must buy from the miners and they wish to place this burden upon the railways.

There is already a considerable market for mine-run coal and if the operators are able to sell all railway coal on a mine-run basis they will for some years be readily able to dispose of the slack obtained in the preparation of domestic lump coal. If necessary, they can make the consumer pay for washing the slack. They will under these conditions cease their efforts to repeal the mine-run laws. What is worse, they will relax still more the slight discipline remaining in the mine crews. The result will be the practical disappearance of all care in mining coal and the railways will soon be burning nearly pure slack of very poor grade.

Comparative tests seem to show that so long as engine coal is free from slate, there is but little loss in efficiency as the size of lump coal is reduced, provided that the pieces are not small enough to fall through the grates or be carried through the flue by the increased draft used with small sizes of coal. The smallest economical size of coal is determined by the difference in cost of the various sizes and by the character of the coal. The more important properties of the coal which affect this are its specific gravity and coking quality. The valuable coal certainly includes many of the smaller lumps removed as slack by the 1½-inch screens common in the southwest.

When fine coal is burned, the large lumps must be broken into rather small pieces before firing to secure the best results. This requires a good deal of labor and the fireman can hardly do it by hand on large engines. Breaking the lumps by hand also makes an undue proportion of slack. For these reasons some coal is already being broken mechanically before it is loaded upon the tenders. The most valuable engine coal is, therefore, that which can be crushed to yield the largest proportion of pieces between, say 1 in. and 3 in. across and the least proportion of slack less than possibly ½-in. across.

It is generally admitted that the railways must buy a certain amount of slack coal in order to protect the operators, and preserve their fuel supply, but even though much of the so-called slack has value it is not worth as much as lump coal. It seems proper, therefore, that coal contracts should name one price for lump coal broken down to a desirable size and a less price for coal of a size below a limit determined by the railway as uneconomical for the particular field. Coal which is carelessly mined also contains slate. This not only has no value but is a positive detriment.

The scale of prices for different sizes of coal can be adjusted after trial so that the return to the operator will equal the average price of the coal bought under either of the present systems. It might even be greater with profit to the railways. After preliminary tests the railway should invite bids for coal upon the basis of, say, four times as much per ton for lump coal as for coal which will go through a half-inch opening, or whatever size the road places as the limit.

When the operator sells coal on its ability to break with little slack formation and its freedom from slate, he will find it economical to take out as much slack as he can sell elsewhere and the railway can serve as a refuge in time of need, to prevent the wasting of slack. This arrangement will certainly cause the operator to get out the largest amount of solid lump coal as free as possible from slate. Such contracts can be used as inducement to get a good quality of coal from the many good miners and enable these men to coax their fellows to do better work even under mine-run conditions.

Discussion.—The Rock Island succeeds in getting a good quality of coal by showing the miners that it is to their own interest to produce it and by threatening loss of business unless good coal is furnished. Better methods of sampling for tests are also urged. The mine-run law is being fought in Arkansas and the roads' best protection is to pay a bonus for lump coal and less for slack.

A NATIONAL ARBITRATION TRIBUNAL.

Representative George E. Foss, of Illinois, has introduced in Congress a bill to create a rational arbitration tribunal to consist of six members, one of whom shall be, ex-officio, the secretary of commerce and labor, and the other members to be appointed by the president. The members first appointed would serve for two, three, four, five and six years, but their successors would be appointed for terms of six years. At least three of the appointed members would constitute a quorum, and the secretary of commerce and labor would have all the powers of other members, except that of voting. The annual salary is fixed at \$8,000, and a secretary is provided for at a salary of \$4,000. The tribunal would organize by electing a president and a vice-president. Its regular place of meeting would be in Washington, but it would be authorized to hold meetings elsewhere. It will provide that whenever there shall arise a controversy on earnings, wages, hours of labor or conditions of employment in which a strike or lock-out is threatened or is in existence, and in which there is involved interstate commerce or commerce in any of the territories or the District of Columbia, it shall be right and lawful for either party to present to the tribunal a sworn petition setting forth its claims and demands. The petition shall, in substance, be a request to the tribunal to investigate all matters involved, and render a decision on its merits. The petition shall also express a full agreement on the part of the one presenting it, to abide by the decision of the tribunal. If the tribunal, in its discussion, deems a petition and the subject matter involved such as to warrant an exercise of its functions, it shall within a reasonable time transmit to the other party to the dispute, a copy of the petition, requesting the other party to make a sworn answer to it within a specified

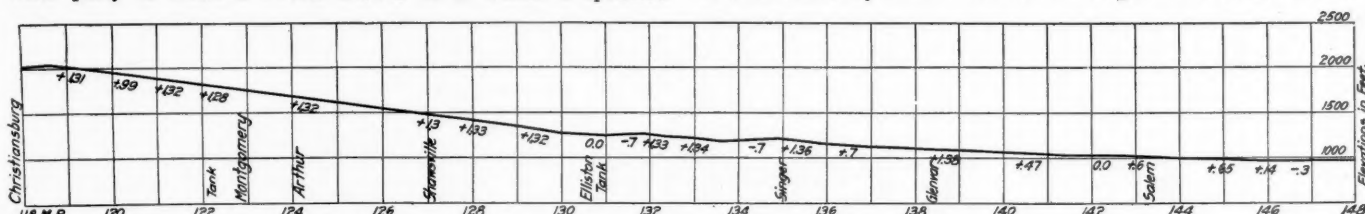
COMPARATIVE TESTS OF MALLET LOCOMOTIVES; NORFOLK & WESTERN.

The Norfolk & Western has recently made a thorough test of two types of Mallet compound locomotives which were received and placed in service during May and June, 1910. The general dimensions of these locomotives are as follows:

Engine No.	993	998
N. & W. classification	X-1	Y-1
Rigid wheel base	15 ft. 6 in.	15 ft. 6 in.
Total wheel base, engine and tender...	72 ft. 10 in.	83 ft. 1½ in.
Total length, engine and tender	88 ft. 11½ in.	92 ft. 5¾ in.
Weight on drivers	376,800 lbs.	370,000 lbs.
Total weight	376,800 lbs.	400,000 lbs.
Diameter of drivers	56 in.	56 in.
Cylinders, in.	24½ and 39 x 30	24½ and 39 x 30
Steam pressure	200 lbs.	200 lbs.
Tractive effort	85,000 lbs.	85,000 lbs.
Valves	Piston and slide	Piston
Heating surface	5,388 sq. ft.	5,894 sq. ft.
Grate area	75 sq. ft.	75 sq. ft.
Exhaust nozzle	{ 6 in. dia., ¾ in. bridge	{ 7 in. dia., ¾ in. bridge

Engine 993 has four pairs of drivers for each engine and is of the 0-8-8-0 type, while 998 has a pair of truck and a pair of trailing wheels in addition, and is of the 2-8-8-2 type. The principal difference in the two locomotives is in the boiler, the front 63 in. of the boiler for engine 998 being separated from the boiler proper by a 54-in. space. This front section is fitted with tubes the same as the back portion of the boiler and is used as a feed water receiver or preheater. Water is delivered directly to this section by the injectors and overflows from it into the main portion of the boiler. Observations were made of the temperature of the water as it passed from one section to the other.

The amount of coal used on the tests was measured carefully; that used during delays was accounted for separately. An effort was made to have a clean uniform fire at the beginning of each trip and to have it burn to the same condition at the end of each test. The water was carefully measured by calibrating the tank and using gages at each of its four corners. The initial and final water observations were made with the engine standing on the same track elevation. The various water losses were also taken into consideration. For instance, the injector overflow was collected and measured; stroke counters were connected to both air pumps, which gave a basis for calculating the amount of steam used by them. The loss through the calorimeters was



Profile of Norfolk & Western Between Roanoke, Va., and Christiansburg.

number of days, and if the other party makes no answer as requested, or refuses to submit the matters in the controversy to the arbitration tribunal, and to agree to accept and to abide by the decision, the original petition shall be made known to the public. If the parties agree to arbitration, the tribunal shall proceed to arbitration. Its findings shall not be made public without the consent of the parties, unless one of the parties agrees to abide by the tribunal's findings, in which case it will be made public. The tribunal is given the power to subpoena witnesses and compel them to testify.

FOREIGN RAILWAY NOTES.

The construction of the railway from Choapa, Chile, to Salamanca was completed on December 19, 1910.

The Brussels chamber of deputies has passed a bill authorizing the Société des Grands Lacs to issue \$5,000,000 additional capital for the continuation of the Great Lakes Railway toward Lake Tanganyika in Africa.

also noted and corrections were made for it. Provision was also made for estimating closely the loss of steam through the pop valves in the following manner: The pop casings were drilled and tapped and plugs with a 1/16-inch diameter orifice were screwed in flush with the inside of the casing; these plugs were then connected to a pipe line running back to a condensing coil in the tank. A small percentage of the steam discharged through the pops passed through these orifices and was condensed and collected in a small tank arranged for this purpose. With the engine stationary and the boiler full of water, the engine was fired to keep the pops up until the height of the water in the boiler receded to the bottom of the gage glass. The injectors were then put on and the boiler filled to the original height. With the use of the calibrated tank, it was then possible to determine the amount of water required to fill the boiler which corresponded with the amount discharged through the pops. The ratio of the water discharged through the pop to the water collected from the condensor was used for determining the pop loss on each trip.

The draft was measured by open water manometer tubes and

the quality of the steam was determined by the use of Peabody throttling calorimeters. The draw bar pull, or dynamometer horse power, was determined by recording instruments in the Westinghouse Air Brake Company's dynamometer car No. 5. The temperature of the gases was determined by a Hoskin's pyrometer. On engine 998 it was taken in the front of the smokebox, back of the reheater and in the combustion chamber. The temperature of the water passing from the reheater to the boiler proper was also noted. On engine 993 the temperature was taken in the front end of the smokebox and back of the baffle plate.

A general comparison of the performance of the two engines

While the data in this table is intended to show the distribution of steam per hour for the running time, it cannot be considered as absolutely accurate. For instance, although an effort was made to retard evaporation during delays, there was of course an increase in the boiler pressure and also a consumption of steam by the air pumps, as well as some loss through the safety valves. Thus, although the calculations are based on the running time, the amount of steam developed and the losses cover the entire performance.

Table IV shows the average steam pressures, quality of steam and pressures and temperatures in the reheater for the six trips of each engine.

TABLE I.—GENERAL PERFORMANCE—ROANOKE TO CHRISTIANBURG.
Duration of Test, Hours.

Eng. No.	Date.	Total.	Delay.	Running.	Miles Run.	Speed, M. H. P.	Train Tonnage.	Number Cars.	1,000 Ton Miles.	Pounds of Coal per 1,000 Ton Miles.
998.....	9-19-10	5.267	1.75	3.517	29.73	8.5	1,579.1	23	46.947	251.3
998.....	9-20-10	3.493	.865	2.628	29.7	11.3	1,415.8	20	42.049	240.2
998.....	9-23-10	3.613	1.114	2.499	28.88	11.6	1,415.8	20	40.888	283.7
998.....	9-24-10	3.537	.882	2.655	29.26	11.0	1,415.8	20	41.426	270.4
998.....	9-28-10	3.064	.672	2.392	29.73	12.4	1,462.8	20	43.489	310.4
998.....	9-29-10	3.005	.692	2.313	29.72	12.8	1,462.8	20	43.474	312.8
Average		3.663	.996	2.667	29.5	11.06	1,458.7	20.5	43.046	278.1
993.....	10-10-10	2.783	.690	2.093	29.76	14.2	1,364.3	20	40.601	275.9
993.....	10-11-10	3.334	.935	2.399	29.75	12.4	1,541.1	23	45.847	279.2
993.....	10-12-10	3.264	1.035	2.229	29.74	13.3	1,541.1	23	45.832	279.3
993.....	10-13-10	3.102	.93	2.172	29.76	13.7	1,541.1	23	45.863	274.7
993.....	10-14-10	3.248	.797	2.451	29.56	12.1	1,541.1	23	45.555	272.2
993.....	10-15-10	3.146	.893	2.253	29.87	13.3	1,541.1	23	46.032	260.7
Average		3.146	.88	2.266	29.74	13.12	1,511.6	22.5	44.955	273.7

is shown in Table I. The tests were made between Roanoke, Va., and Christiansburg, a profile of this portion of the road being shown on the accompanying illustration. It will be seen that there was a reduction of 15 per cent. in the running time of engine 993, with a 19 per cent. increase in speed, although it hauled 9.8 per cent. more cars and 3.6 per cent. more tonnage than engine 998, with a reduction of 1.6 per cent. in coal used per thousand ton miles.

Data as to the amount of fuel used, the rate of combustion, the drafts and the temperatures of the gases for the different test trips is shown in Table II. The increased coal consumption of engine 998 for the last two runs was due to the removal of a portion of the perforated plate to overcome trouble due to the stopping up of the holes at its front end. This change resulted in a much heavier draft, accompanied by a greater loss in fuel through the stack and a decrease in the boiler efficiency.

TABLE IV.—PRESSURE AND QUALITY OF STEAM, AND PRESSURE AND TEMPERATURE AT REHEATER.

Engine No.	993	998
Pressure, lbs. per sq. in.		
Boiler	193.2	191.3
High pressure delivery	165.2	167.8
Low pressure delivery	48.0	54.9
Quality of steam—per cent.		
High pressure delivery .....	.83	.943
Low pressure delivery	2.02	1.108
Temperature of steam, deg. Fahr.		
Entering reheater .....	....	306.94
Leaving reheater .....	....	301.53
Degrees reheat .....	....	—5.41
Steam pressure, lbs. per sq. in.		
Entering reheater .....	....	59.29
Leaving reheater .....	....	54.9

The minus sign before "degrees reheat," indicates a loss in the temperature of the steam while in the reheater, which was no doubt due to the increased volume of the heater. This would indicate that there is no marked advantage in this arrangement. The reheater, however, had a drying influence on the steam, as

TABLE II.—FUEL, RATE OF COMBUSTION, DRAFTS AND TEMPERATURE OF GASES.
Fuel, in Pounds.

Eng. No.	Total.		Per Hour.		Rate of Combustion per Hour.		Draft, In. of Water.		Temperature of Escaping Gases.			
	Fired.	Running.	Total.	Running.	Sq. Ft. Grate Area.	Sq. Ft. Heating Surface.	Smoke Box.	Fire Box.	Front Smoke Box.	Combustion Chamber.	Back of Baffle Plate.	Back of Reheater.
998.....	13,200	11,800	2,506	3,355	44.73	.5693	4.28	1.78	....	....	....	....
998.....	10,600	10,100	3,035	3,843	51.24	.652	4.32	1.7	....	....	....	....
998.....	11,800	11,600	3,266	4,642	61.89	.7876	5.67	1.72	....	....	....	....
998.....	11,700	11,200	3,307	4,218	56.24	.7157	5.73	1.8	....	....	....	....
998.....	14,400	13,500	4,700	5,643	75.24	.9574	7.92	2.41	374.5	583.1	....	452.
998.....	14,000	13,600	4,659	5,880	78.4	.9976	8.3	2.3	377.5	615.2	....	475.1
Average.....	12,617	11,967	3,579	4,597	61.29	.7799	6.12	2.09	376.1	599.4	....	463.8
993.....	11,300	11,200	4,056	5,351	71.34	.9932	6.26	1.45	473.7	....	480.	....
993.....	12,900	12,800	3,875	5,335	71.13	.9901	7.00	2.3	481.4	....	491.1	....
993.....	13,000	12,800	3,983	5,742	76.56	1.0657	7.83	2.21	526.4	....	540.6	....
993.....	12,800	12,600	4,127	5,801	77.34	1.0767	8.02	2.4	527.3	....	564.2	....
993.....	12,400	12,400	3,817	5,058	67.44	.9388	6.87	2.14	518.6	....	538.	....
993.....	12,400	12,000	3,943	5,327	71.02	.9887	7.36	1.9	523.3	....	532.7	....
Average.....	12,467	12,300	3,967	5,436	72.47	1.0089	7.24	2.19	514.2	....	527.0	....

The omission of the gas temperatures in the earlier tests was due to a delay in receiving the instruments. The average smoke box draft on engine 993 exceeded that of engine 998 by 18 per cent., because of the use of the smaller nozzle. There is also an 18 per cent. increase in coal consumption per square foot of grate area per hour. The feed water heater and reheater tubes in engine 998 had a marked effect on the temperature of the escaping gases, there being a difference of 37 per cent. in favor of engine 998.

The amount of water and steam used is shown in Table III.

indicated by the low per cent. of moisture in the steam delivered to the low pressure cylinders. The boiler pressures for both locomotives were fairly uniform and regular, and as indicated in the table, the average boiler and high pressure delivery pipe pressures were practically identical for both the locomotives.

The average equivalent evaporation per pound of coal for all tests is given in Table V, and shows well for both engines. While the results may at first glance appear to be high, it must be remembered that the boilers were very large and that the evaporative efficiency was high, due to the low temperature of

the escaping gases. The results for the individual tests were quite uniform for each engine and compared favorably with the results on the Pennsylvania Railroad testing plan at St. Louis.

TABLE V.—EQUIVALENT EVAPORATION.

Engine No.	993	998
Ratio, total coal to total water.....	7.85	8.666
Equivalent evaporation from and at 212 deg. Fahr.		
Total	118,276 lbs.	130,889 lbs.
Per hour	52,270 lbs.	49,643 lbs.
Per sq. ft. heating surface.....	9.70 lbs.	8.42 lbs.
Per lb. of coal.....	9.49 lbs.	10.46 lbs.

For instance, the Michigan Central consolidation cross compound locomotive gave a maximum equivalent evaporation of 12.01, and the Santa Fe four-cylinder tandem compound an equivalent evaporation of 11.51 lbs. of water per pound of coal. On an

the indicator cards were taken and give a measure of efficiency of the engine and the boiler. For instance, engine 993 developed an average of 1,604.3 indicated horse power, with a corresponding draw bar horse power of 1,347, or 83.9 per cent. of the indicated horse power. For engine 998 the draw bar horse

TABLE VII.—ENGINE AND BOILER EFFICIENCY.

Engine No.	993	998
Indicated horse power—		
High pressure cylinders.....	889.9	757.1
Low pressure cylinders.....	714.4	640.6
All cylinders	1,604.3	1,397.7
Draw bar pull	46,021 lbs.	40,363 lbs.
Draw bar horse power.....	1,347.0	1,093.7
Boiler horse power	1,515	1,439
Boiler efficiency	64.9 per cent.	77.1 per cent.

power was 78.2 per cent. of the indicated horse power. The

TABLE III.—WATER AND STEAM.

Eng. No.	Pounds of Water, Total.			Temp. of Feed Water.	Pounds of Steam Per Hour, Running Time.				Temp. of Water Leaving Preheater.
	Supplied to Injector.	Inject. Overflow.	Supplied to Boiler.		Moist Steam from Boiler.	Pumps and Calorm.	Pop.	To Cylinder.	
998.....	125,988	915	125,073	64.6	35,562	3,441	5,800	26,321	6.0
998.....	102,044	695	101,349	66.17	38,565	3,153	2,892	32,520	6.5
998.....	103,400	580	102,820	65.25	41,146	3,144	5,122	32,880	7.0
998.....	107,290	639	106,651	65.3	40,172	3,118	4,219	32,835	6.8
998.....	105,800	580	105,220	66.5	43,980	2,655	4,682	36,643	7.5
998.....	110,530	938	109,592	64.3	47,381	2,633	7,436	37,312	8.0
Average.....	109,175	725	108,540	65.35	41,134	3,024	5,025	33,085	7.0
993.....	88,020	800	87,220	61.8	41,672	2,373	490	38,809	7.7
993.....	96,260	432	95,828	59.3	39,933	2,761	1,197	35,975	7.4
993.....	101,260	552	100,708	59.8	45,181	2,602	2,301	40,278	8.4
993.....	101,890	469	101,421	59.9	46,695	2,462	3,022	41,211	8.7
993.....	102,110	603	101,507	60.	41,408	2,651	1,874	36,883	7.7
993.....	99,260	451	98,809	61.	43,864	2,785	2,731	38,348	8.1
Average.....	98,133	551	97,582	60.3	43,126	2,606	1,936	38,584	8.0

evaporative basis there is a difference of 10 per cent. in favor of engine 998.

The drop in pressure between the high and low pressure cylinders of engine 998, as shown by the indicator cards, was 9.2 lbs., while for engine 993 it was only 4.9 lbs., or 46.7 per cent. less. The greater drop in pressure in engine 998 was evidently due to the friction and the increased volume of the numerous passages through the reheater. The mean effective pressures calculated from the indicator cards, but not reproduced here, indicate that the valves on both engines were set to give a well balanced performance in both the right and left cylinders,

boiler horse power developed by engine 998 is slightly lower than that for engine 993, but the boiler efficiency is 18.8 per cent. higher. From the design of the boiler and the low temperature of the escaping gases, we would naturally expect a higher efficiency from the boiler of engine 998. The data for the individual tests indicate that its efficiency varied from 68 per cent. to 89.4 per cent., although there seems to be some question as to the correctness of the latter figure. The boiler efficiency of engine 993 for the various tests was much more uniform and varied from 61.3 per cent. to 67.4 per cent.

The relation of the power developed, both indicated and draw

TABLE VI.—DISTRIBUTION OF POWER.

Eng. No.	Indicated Horse Power.									
	Right Side.		Left Side.		Total.		Cylinders.		Ratio of High to Low Pres.	
	High. Pres.	Low Pres.	High Pres.	Low Pres.	Right Side.	Left Side.	All Cylinders.	High Pres.	Low Pres.	
998.....	327.7	269.9	314.6	268.2	597.6	582.8	1,180.4	642.3	538.1	1.19
998.....	341.1	290.7	344.1	283.5	631.8	627.6	1,259.4	685.2	574.2	1.19
998.....	377.0	304.2	384.8	307.8	681.2	692.6	1,373.8	761.8	612.0	1.24
998.....	379.2	307.5	388.6	301.6	686.7	690.2	1,376.9	767.8	609.1	1.26
998.....	397.1	344.1	394.2	340.2	741.2	734.4	1,475.6	791.3	684.3	1.16
998.....	398.2	364.1	398.2	361.9	762.3	760.1	1,522.4	796.4	726.0	1.10
Average.....	377.9	321.8	379.2	318.8	699.7	698.0	1,397.7	757.1	640.6	1.18
993.....	411.1	337.3	437.3	336.2	748.4	773.5	1,521.9	848.4	673.5	1.26
993.....	430.9	355.8	452.2	349.3	786.7	801.5	1,588.2	883.1	705.1	1.25
993.....	472.2	396.8	493.5	389.2	869.0	882.7	1,751.7	965.7	786.0	1.23
993.....	468.7	371.3	486.7	370.3	840.0	857.0	1,697.0	955.4	741.6	1.29
993.....	412.5	335.5	427.9	337.1	748.1	765.0	1,513.1	840.4	672.7	1.25
993.....	425.2	360.9	435.4	358.4	786.1	795.1	1,581.2	861.9	719.3	1.20
Average.....	435.6	358.6	454.3	355.8	794.2	810.1	1,604.3	889.9	714.4	1.25

as well as an equally good distribution of steam in both the front and back ends of each cylinder for both types of locomotives.

The distribution of power in the cylinders of both engines for all of the tests is shown in Table VI. The purpose of this table is to show the relation between the power developed in the high and low pressure cylinders of each engine. The average of the ratios of power existing between the high and low pressure cylinders of engine 998, is 1.18, while for engine 993 it is 1.25, showing that the engines were very much alike in this respect.

The data given in Table VII is a comparison of the conditions indicated by the dynamometer chart at the times when

bar, to the heating surface and grate areas, is shown in Table VIII.

TABLE VIII.—HORSE POWER RELATION.

Engine No.	993	998
I. H. P. per sq. ft. heating surface.....	.298	.237
I. H. P. per sq. ft. of grate area.....	21.4	18.6
D. B. H. P. per sq. ft. of heating surface.....	.250	.186
D. B. H. P. per sq. ft. of grate area.....	18.0	14.6
H. P. of boiler at dome.....	1,515	1,439

TABLE IX.—POUNDS OF STEAM THROUGH CYLINDERS PER THOUSAND TON MILES.

Engine No.	993	998
1,000 ton miles, excluding weight of engine and tender	44.955	43.046
1,000 ton miles, including weight of engine and tender	52.429	50.803

Water through cylinders (pounds)—		
Per 1,000 ton miles, excluding weight of engine and tender.....	1,943	2,020
Per 1,000 ton miles, including weight of engine and tender.....	1,665	1,711
Total.....	87,273	86,890
B. T. U. through cylinders—		
Per 1,000 ton miles, including weight of engine and tender.....	1,996,331	2,050,900

A comparison of the horse power results from engine 998 as shown in Table X, indicates that 78.2 per cent. of the power

TABLE X.—HORSE POWER.
Indicated H.P.

Eng. No.	Speed, M.P.H.	High Pres. Cylinder.	Low Pres. Cylinder.	Total I.H.P.	Draw Bar Pull, Pounds.	Draw Bar H.P.	Ratio I.H.P. to Draw Bar H.P.
998.....	8.5	642.3	538.1	1,180.4	43,387	973.0	1.21
998.....	11.3	685.2	574.2	1,259.4	34,559	958.1	1.31
998.....	11.6	761.8	612.0	1,373.8	41,413	1,124.1	1.22
998.....	11.0	767.8	609.1	1,376.9	38,481	1,063.3	1.29
998.....	12.4	791.3	684.3	1,475.6	39,254	1,108.2	1.33
998.....	12.8	796.4	726.0	1,522.4	42,059	1,226.2	1.29
Average	11.06	757.1	640.6	1,397.7	40,363	1,093.7	1.28
993.....	14.2	848.4	673.5	1,521.9	40,379	1,235.8	1.21
993.....	12.4	883.1	705.1	1,588.2	44,125	1,311.5	1.21
993.....	13.3	965.7	786.0	1,751.7	53,625	1,552.4	1.13
993.....	13.7	955.4	741.6	1,697.0	45,452	1,455.6	1.17
993.....	12.1	840.4	672.7	1,513.1	46,071	1,255.8	1.20
993.....	13.3	861.9	719.3	1,581.2	46,708	1,287.9	1.23
Average	13.12	889.9	714.4	1,604.3	46,021	1,347.	1.19

developed in the cylinders was transmitted to the draw bar, while for engine 993, 84 per cent. of the indicated horse power was available at the draw bar.

A summary of the average results of the tests is given in Table XI, and clearly shows that engine 998 was superior

TABLE XI.—SUMMARY OF AVERAGE RESULTS.

	Average of Six Trips.		Per cent. in favor of	
	Engine No. 998.	Engine No. 993.	Eng. 998.	Eng. 993.
Boiler pressure, pounds per sq. in.....	191.3	193.2	....	....
Water supplied boiler, pounds.....	108,450.0	97,582.0	....	....
Coal, total, pounds.....	12,617.0	12,467.0	....	....
Ratio total water to total coal.....	8.66	7.83	11.0	....
Equivalent evaporation per sq. ft. heating surface per hour.....	8.42	9.70	....	15.2
Equivalent evaporation per pound of coal.....	10.46	9.49	10.0	....
Coal per sq. ft. of grate area per hour.....	61.20	72.40	....	18.
Moisture in steam, high press. (per cent.).....	.94	.83	....	13.2
Moisture in steam, low press. (per cent.).....	1.10	2.02	83.7	....
Draft in front end of smoke box (In. of water).....	6.1	7.2	....	18.
Temperature of escaping gases, deg. Fahr.	376.1	514.2	37.0	....
Drop in steam press. between high and low press. cylinders (l. side).....	9.2	4.9	....	46.9
Boiler horse power.....	1,439.0	1,515.0	....	5.2
Boiler efficiency.....	77.1	64.9	18.8	....
Distance of run, miles.....	29.5	22.7	....	....
No. of cars in train.....	20.5	22.5	....	9.8
Tonnage of train.....	1,458.7	1,511.6	....	3.6
Speed, miles per hour.....	11.0	13.1	....	19.0
Pounds of coal per 1,000 ton miles, excluding delays and wt. of engine and tender.....	278.1	273.7	....	1.6
Indicated horse power.....	1,397.7	1,604.3	....	14.8
Draw bar horse power.....	1,093.7	1,347.0	....	23.2
Per cent. of draw bar to indicated horse power.....	78.2	83.9	....	7.2

only in the items pertaining to boiler performance. On the other hand, engine 993 also has an important advantage in boiler performance—the difference in the drop in steam pressure between the high and low pressure cylinders. Thus, while engine 998 gives a better boiler performance up to the time the steam passes from the high pressure to the low pressure cylinders, the advantage is largely offset, due to the much greater drop in pressure between the two cylinders, as compared to engine 993. As far as engine performance is concerned, engine 993 handled 9.8 per cent. more cars and 3.6 per cent. more tonnage, at an increase of 19 per cent. in speed. The consumption of coal per thousand ton miles on the two locomotives did not differ greatly, there being a slight difference in favor of engine 993. The indicated and draw bar horse power, as well as the per cent. of draw bar to indicated horse power, were all equally favorable to engine 993. We are indebted to W. H. Lewis, superintendent motive power, for this information.

The Rhaetian Railways Company is said to have decided on the electrification of all its lines in the Engadine, Switzerland.

STATISTICAL MEASURES OF FREIGHT CAR EFFICIENCY.

BY R. J. MCCARTY,

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The purposes of this discussion are:

1. To show that on account of the diverse conditions on which freight car efficiency depends it cannot be measured by any single statistical ratio.

2. To suggest several different ratios each of which shall serve as a measure of freight car efficiency when considered with regard to the special practical conditions upon which the value of the ratio depends.

The highest efficiency of freight car service on any given railway manifestly requires that each car on the line shall, during any given time, with proper expedition and at a minimum expense, carry the maximum number of tons one mile.

This naturally requires that all tracks shall be properly maintained; that the road shall be properly equipped with locomotives and cars; that all this equipment shall be kept in working condition up to its full capacity; that the proper volume of traffic shall be secured; that each locomotive and each car shall be loaded to its full capacity; that there shall be no unnecessary hauling of empty cars; and that all cars shall be switched, loaded, hauled and unloaded with the greatest expedition consistent with safety.

The conditions mentioned being to a greater or less extent independent of one another, a proper consideration of the subject manifestly requires that each shall be considered separately.

As the question of track maintenance does not come within the scope of this discussion, it will be assumed that all the tracks are kept up to the proper standard.

The efficiency of the mechanical department in keeping each freight locomotive in good working order up to its full rated load, will be called "Mechanical efficiency of freight locomotives," and may be expressed by the ratio,

Average total tractive force of all freight locomotives in good order for the whole given time.

Average total tractive force of good and bad order freight locomotives on hand for the whole given time.

This ratio should be readily determinable from the records of the mechanical department.

The efficiency of the mechanical department in keeping all freight cars in good order and up to their full rated carrying capacity will be designated as "Mechanical efficiency of freight cars," and may be expressed by the ratio,

Average number of good freight cars available for the whole given time.

Average number of good and bad order freight cars on hand during the whole given time.

This ratio should be also readily determinable from the records of the mechanical department.

The roadbed and track being in first class condition, and the ratios representing the mechanical efficiencies of freight locomotives and cars having proper values, it is manifest that the property is in a suitable physical condition for handling a certain volume of freight traffic with the highest degree of economy and dispatch.

Now the highest degree of economy requires that each locomotive and each car shall be given its full rated load and that there shall be no unnecessary empty haul.

The efficiency of the transportation department in giving to each locomotive its full rated load, will be designated as "Loading efficiency of freight locomotives," and may be expressed by the ratio,

Actual average gross load of freight locomotives used for the whole given time.

Average rated gross load of freight locomotives used for the whole given time.

This ratio is readily obtainable from statistics in general use.

In case the grades of a road should be practically uniform so that the rated load of any given locomotive would be the same over all districts, this ratio would be a measure of the general ability of the transportation officials. In order, however, to obtain a basis for comparing the results obtained on one district with those of another it will be necessary to determine the ratio for each operating district. This, however, may readily be done without undue expense.

Efficiency in giving to each car its maximum rated load, will be called "Loading efficiency of cars," and may be expressed by the ratio,

Average actual load of cars used for the whole given time.

Average rated load of cars used for the whole given time.

This ratio, when determined from all the cars used in carrying freight during the given time would give a general average which, when taken by itself, would not under ordinary conditions be a correct measure of loading efficiency, particularly when the traffic consists of large quantities of light merchandise, furniture, agricultural implements and other freight with which a car cannot be loaded to its full capacity. To give this ratio its full significance, therefore, it is necessary to determine it separately for different classes of traffic. This may be done without undue clerical labor by determining it from the conductor's wheel reports. To this end the conductor's wheel report should be made to show under the head of each heavy commodity which moves only in car loads and in large volumes, and under the head of merchandise and other light freight, in one column the actual load of the car taken from the way-bill and in another column the marked capacity of the car. The totals of these columns taken from all of the wheel reports for the given time and cast up, will furnish the numerator and denominator of the ratio for each classification of commodity that may be required.

Efficiency in reducing empty car haul to a minimum will be designated as "Car mileage efficiency," and may be expressed by the ratio,

Total theoretical minimum empty car mileage required under actual conditions of traffic and calculated from the actual loaded car mileage.

Actual empty car mileage.

The numerator of this ratio may be determined from the loaded car mileage as follows: The theoretical minimum empty car mileage between any two adjacent stations is equal to the difference between the loaded car mileage in one direction and the loaded car mileage in the opposite direction moving between those stations. As a first step, therefore, it will be necessary to ascertain the theoretical empty car mileage between each station and the station adjacent, and this may be done by tabulating the total number of car-loads moving from each station to every other station somewhat after the method used in determining the tons one mile.

This tabulation having been completed, the total theoretical empty car mileage during the given time may be readily ascertained from the loaded car mileage by deducting from the loaded movements in one direction between any two adjacent stations, the loaded movements in the opposite direction, multiplying the difference by the distance between the stations, and casting up the totals. This may be readily done if the form of the table is properly designed. As nearly as can be determined in advance of the actual performance of the work, the cost of completing this calculation for any one month on a road 1,000 miles long with a traffic density of 100,000 net tons per month, would be \$150. The result obtained in this way would represent the theoretical minimum empty car mileage required for the traffic during the month provided that each car should at the end of the month be at the station where it was at the beginning.

This, of course, will never happen, but the extent to which the relative positions of the cars at the beginning and at the end of the month varies from this theoretical condition may be determined approximately by the consideration that if each car did return to its original position then the sum of the actual loaded and empty car mileage in one direction would be exactly equal to the sum of the actual loaded and empty car mileage in the other direction during the month. Therefore, the difference between the actual loaded and empty car mileage in the other direction during the month would indicate the extent to which the cars have departed from their general original positions.

This difference, it may be fairly assumed, would arise from certain conditions over which the management of the road has no control, and, therefore, it should be deducted from the empty car mileage determined by tabulation, as explained.

The numerator having been determined in this way, and the denominator having been determined by taking the total of the actual empty car mileage in both directions, the ratio would be established.

This ratio for the different districts of the road may be established without undue expense, and in this way could be obtained the measure of efficiency for each district which would be of great value in comparing the abilities of the district superintendents or others in the immediate charge of car movement.

The highest efficiency in economy and despatch requires that all cars shall be switched, loaded, hauled and unloaded with the greatest expedition consistent with safety. This will be called "Movement efficiency," and may be expressed by the ratio,

Theoretical average number of cars required for the whole given time calculated on basis of maximum speed and minimum delays.

Average number of cars used for the whole given time.

The numerator of this ratio may be obtained as follows:

To the total theoretical minimum empty car mileage determined for the numerator of "Car Mileage Efficiency," add the total loaded car mileage, and divide the sum by the average loaded haul. The quotient will represent the theoretical number of trips required for the traffic during the given time.

To determine the theoretical number of trips which a car should make, divide the average loaded haul by the average speed of the freight trains in miles per hour, and reduce the quotient to days. To this quotient so reduced add the number of days allowed for switching, loading and unloading, and divide the number of days in the given period by the result thus obtained. The quotient will represent theoretically the average number of trips which each car would make during the given time. Divide the total number of trips by this quotient, and the result will represent the theoretical average number of cars required for the whole given time calculated on maximum speed and minimum delays. Divide this quantity by the average number of cars used for the whole given time previously determined for the ratio for "Loading Efficiency of Cars," and the result will represent the "Movement Efficiency."

In this ratio the terms "maximum speed" and "minimum delays" are supposed to be based upon the observed conditions under which the road is being operated. The maximum speed should be fixed by the management at the highest average speed at which it is practicable to operate freight trains, and the minimum delays should be fixed at the minimum average delay which is found to be possible in order to permit of the proper loading, switching and unloading of cars. The extent to which this ratio differs from unity will indicate the extent to which the number of cars used exceeds the number of cars theoretically necessary to handle the traffic.

Ratios indicating the efficiency in keeping equipment in good order and condition, in loading such equipment to its full capacity in avoiding unnecessary hauling of empty cars, and unnecessary delays, having been established, it now remains to find an expression which shall indicate the efficiency with which

freight equipment is adjusted to the volume of traffic generally available and the efficiency of the traffic department in securing such traffic.

The accuracy with which the facilities are adjusted to the volume of available business and the efficiency of the traffic department in securing that business, are under certain conditions indicated by the extent to which the facilities are used, and this is particularly true of freight equipment. For, if the freight equipment is accurately adjusted to the available tonnage, the traffic department would be responsible for all such equipment unnecessarily idle, while if all available traffic is secured, properly loaded and handled, all equipment that remains permanently idle is evidence of improper adjustment, and to that extent may be the result of mistaken policy.

The accuracy with which freight car equipment is adjusted to the volume of traffic generally available, and the efficiency of the traffic department in securing such traffic, will for want of a better term be denominated as "Traffic Efficiency," and may be expressed by the ratio,

Average number of freight cars used for the whole
given time.

Average number of good order freight cars available
for the whole given time.

Now, it is manifest that should it be financially or physically impossible to provide freight cars sufficient for unsolicited traffic, this ratio might with perfect station and yard service approach closely to unity. In such a case the ratio would, of course, furnish no indication of the efficiency which the management might display under different conditions, but it would indicate that under the circumstances the best results were being obtained.

Again, a superabundance of traffic is always too conspicuous to require either argument or demonstration, so that the conditions under which this ratio should approach closely to the value of unity may be easily recognized. Therefore, these conditions being present, the failure of the ratio to approach the value of unity would indicate that available equipment had been allowed to remain idle in time of need, and thus would point to some defect in station yard or train service.

The ratio in question, therefore, will, according to circumstances, indicate either a deficiency or excess of equipment, a deficiency or excess of traffic, or the absence or presence of efficiency in procuring or transporting traffic. Whence, if properly used with due regard to commercial and other general conditions, this ratio as a proper measure of results is highly significant.

It is manifest that the value of none of the ratios given can be maintained at unity except under ideal conditions, and perfect management:

1. Because of the presence on every road of arbitrary conditions or those which are in the nature of things beyond the control of the most perfect management.

2. Because of conditions which should be controlled by ordinary good management, but which may not be so controlled.

Therefore, in applying the ratios as measures of practicable efficiency, it is necessary that allowances should first be made for arbitrary conditions.

These allowances may be determined with a reasonable amount of accuracy from experience by a systematic observation and comparison with each other of similar ratios for different periods, and in this way the highest value practicable on any particular road under average conditions may be established.

These highest practicable values having been established, they would afford fair standards to which all concerned might work, and therefore, any failure to reach such standards should be explained by the parties responsible for the result.

The establishment of the standard values of these ratios for any particular road naturally requires a comprehensive knowledge of the road and of the general conditions under which

it operates, and the determination of these standard values must therefore be made by some high class official. The application of the ratios determined periodically from the actual statistics would then consist of requiring subordinate operating officials to explain the difference between the values of these ratios and the established standard values. This is also a task which can only be performed by a high class official, or under his direction.

To obtain the full benefit of these ratios they should be determined monthly.

In conclusion, it may be remarked that in the hands of an official who merely compares the monthly statistical ratios with unity and makes no systematic effort to have the differences explained, these ratios would be of little practical value. On the other hand, these ratios in the hands of an official who can properly determine their highest practical value and systematically and intelligently compare these standard values with the monthly values, there might be worked out many economies which would otherwise escape notice, the aggregate of which would repay very many times over the total expense involved.

FOREIGN RAILWAY NOTES.

The Brazilian government has approved the definite surveys and estimates of the branch of the Mogyana Railway, extending from Mogy-Mirim to Santos.

The Argentine minister of public works has approved the plans and estimates of the first section of the state railway between Diamante and Curuzu-Cuatia. The opening of the railway from Mazan to Timogasta has also been authorized.

The Russian Ministry of Ways and Communication has definitely decided to adopt on all Russian railways the 24-hour system. The Duma has been asked to allow the credits for the cost of new time-tables and for adding the additional numerals on the dials of the clocks in stations and offices of the system. As soon as this sum is voted the new system will go into effect.

The governor of the department of Antioquia, Colombia, has been authorized to negotiate a foreign loan not exceeding \$3,500,000. This money is to be utilized in the completion of the Antioquia Railroad from the Magdalena river to Medellin, about 130 miles. This railway, half of which is already completed, has thus far been built and operated by the department of Antioquia alone, receiving from the national government a bonus for every mile placed in operation.

An all-rail route has recently been opened between Montevideo, Uruguay and Rio de Janeiro, Brazil, by the construction and linking together of several disconnected railways. The companies which form the all-rail route between the two cities are: The Uruguay Central between Montevideo and Santa Anna, on the Brazilian frontier, 352 miles; the Viacao Ferrea do Rio Grande do Sul, which crosses the state of Rio Grande do Sul from Santa Anna to Alto Uruguay, 506 miles; the Sao Paulo-Rio Grande, which traverses the states of Santa Catharina and Parana to Itarare, 546 miles; the Sorocabana between Itarare and Sao Paulo, 259 miles; and the Central do Brazil from Sao Paulo to Rio de Janeiro, 304 miles, a total of 1,967 miles. The actual running time is 112 hours and the first-class fare (including sleeper accommodations for two nights) is about \$76. With the exception of the two terminal cities and the city of Sao Paulo the route followed is for the most part thinly populated. It is believed that there will not, in the immediate future, be any great volume of through traffic, either passenger or freight, as the ocean voyage is cheaper and more expeditious. Certain sections of the road have been so recently and hastily constructed and the service is so infrequent that the journey is subject to no little discomfort and delay.

REFRIGERATION BY RAILWAYS.

A report on this subject was presented before the annual meeting of the American Association of Refrigeration, which was held in Chicago, May 9-10, 1911. The commission on railway and steamship refrigeration, of which E. O. McCormick, vice-president of the Southern Pacific, is chairman, considered the resolutions adopted last October at the Second International Congress of Refrigeration, at Vienna, Austria.

Experience in this country has demonstrated the value of standard service rules for re-icing refrigerator cars in transit. A closer co-operation should exist between the steamship companies and the railways in this respect.

A higher demurrage charge on perishable goods than on non-perishable goods at destination is necessary and justifiable for several reasons, among which is the fact that the consignees secure a special advantage in the way of temporary cold storage, which saves them the trouble and expense of hauling the goods to a regular cold storage house. The detention of refrigerator cars under ice also gives other special advantages to consignees by enabling them to hold the goods for higher prices, and to peddle the freight from the car instead of hauling it to their houses for sale in the regular way. Among the most important arguments in favor of higher demurrage charges on perishable goods is the fact that the cars designed for the transportation of such commodities should be promptly released and returned to the loading station to protect additional shipments which may perish if cars are not promptly supplied for loading. The railways cannot and should not be expected to own, operate and maintain throughout the year a larger number of refrigerator cars than will properly take care of the perishable freight traffic during the season in which it regularly moves.

The commission is, in a general way, in favor of charging for refrigeration by distance rather than by weight of ice furnished. There are numerous bases for refrigeration charges by American railways, but the best service and the least damage claims on shipments under refrigeration are to be found in connection with the application of through refrigeration charges in lump sums per car, because the entire responsibility of protection of the property rests on the carrier, who therefore adequately performs the duty. On the other hand, when railway tariffs provide a charge for ice per ton, the shipper often tries to save himself a few dollars for ice and limits the amount of protection to be given in transit. This has the effect of depriving the carrier of the privilege of giving adequate protection to the property in accordance with its own judgment. This latter course results in division of responsibility as between the shipper and the carrier. When shippers desire perishable goods to move under refrigeration, they should so state to the carrier, and the latter should be free to protect the property without restriction.

The commission is, in principle, in favor of not including the cost of refrigerating in the rates of transportation, but of charging for it separately. In cases where a road furnishes icing or re-icing service in transit, without any extra charge above the freight rate of transportation, it creates an inequality. As a matter of principle, the rates assessed by railways for transportation as such, should be based on common car service, and an extra charge should be made for all special service of every kind, including icing, heating, etc.

The commission favors the adoption of a uniform rule, that shippers of perishable goods be required to give reasonable and definite instructions on every shipment, as to refrigeration, non-refrigeration or ventilation in transit. The shipper, being experienced in his own particular business, knows better than anyone else the exact condition or relative maturity of the goods when loaded, and therefore may reasonably be expected and required to give instructions regarding proper protection in transit. Such instructions should always be reasonable, clear and definite to prevent any misunderstanding. The Railroad Refrigerator Service Association has suggested a uniform rule which has received the concurrence of several other railway associations, and will presumably be made generally effective in

due course of time. No instructions in detail from shippers are required about the precise manner of re-icing in transit when shipments are transported by carriers subject to a stated refrigeration charge in a lump sum per car, because in such cases the carrier is and should be free to use its own judgment to protect the property adequately. All shipments, however, moving under ventilation, non-refrigeration, or subject to charges for ice by weight, should be covered by reasonable and definite instructions from shippers.

THE SPECIAL COMMITTEE ON RELATIONS OF OPERATION TO LEGISLATION.

The special committee on relations of railway operation to legislation has published its fifth report. Among the most important features of the report are the resolutions regarding the future organization and work of the committee, which were submitted for the consideration of the constituent lines. The resolutions recommended for adoption set forth that the following requisites are necessary for the successful conduct of its future work: That it shall have free access to, and communication with, the railways supporting it and shall have the assurance that it represents the railways; that its membership should represent the several sections of the country as represented by the General Managers' Associations of New York, Chicago, and the Southeast, respectively; that its organization and conduct of its affairs should be such as to permit flexibility in order that it may avail itself of any agency without question of routine, and have the assistance of such sub-committees as it may deem necessary; that the railways it represents shall create and maintain a committee empowered with authority to fill such vacancies as may occur in the membership of the special committee, and to whom it may apply for advice and co-operation. At a meeting of the constituent lines in New York City on May 17 these resolutions were adopted. The committee to fill vacancies in and advise the special committee will be composed of D. Willard, H. U. Mudge, W. G. Besler, J. Kruttschnitt, H. E. Byram, G. L. Peck, T. E. Clarke, C. R. Gray and Fairfax Harrison. Another resolution of the constituent roads was that the special committee submit from time to time, recommendations for uniform practice where a lack of uniformity tends to encourage legislation.

The committee says that it has been deemed advisable to continue the organization of the general committee of railways on the safety appliance standards in order to handle the numerous questions which will undoubtedly arise with respect to the application of these standards to existing equipment, and it urges diligence on the part of the roads in complying with the order of the Interstate Commerce Commission, so that if it proves impracticable to complete the work outlined by the commission within the time limit, such diligence on the part of the railways may have weight with the commission in considering a further extension of time should it be necessary.

The committee is of the opinion that much mandatory legislation is introduced both in Congress and the state Legislatures to require individual lines to adopt a minimum requisite of recognized practice, and it directs the attention of the railways to the desirability of endeavoring to minimize the tendency toward mandatory state legislation on operating matters by applying to state traffic such federal laws as have been passed and by adopting the practice that is used on a majority of roads. It says that it is also desirable that federal in place of state laws be urged where state legislation is under consideration.

In view of the decision of the Supreme Court of the United States, on February 20, 1911, holding the Arkansas Full Crew law constitutional, the committee has issued a circular asking the railways for information as to their present practice in the matter of the size of train and engine crews. The committee has asked the conference committee of the general committee of railways on safety appliance standards to act as a committee on mechanical matters to assist it in handling any mechanical questions that may arise in future. It has also created a committee on engineering matters under the chairmanship of L. C. Fritch.

AMERICAN RAILWAY ASSOCIATION.

The spring meeting of the American Railway Association was held at the United Engineering Society building, New York City, on May 17, 1911. There were present 162 members, represented by 174 delegates.

The executive committee reported that the membership now comprises 349 members, operating 255,537 miles, an increase of 3 members and 1,824 miles. The associate membership now comprises 84 members, operating 4,559 miles, an increase of 360 miles.

In the report of the committee on transportation, several questions and answers concerning practice under the Standard Code of Train Rules were submitted, and which were duly approved by the association. The committee recommended a revised form of the detour agreement, which was adopted. The committee reported that at the request of the committees on signaling of the Railway Signal Association and the American Railway Engineering Association, the reports submitted by those committees were presented to the committee on transportation for consideration, accompanied with the request that the essentials of signaling be outlined or defined for the future guidance of the committees in question. In that connection the committee formulated the following memorandum which was incorporated in its report for the information of the members of the association:

The subject has been carefully analyzed and considered. There are three signals that are essential in operation and therefore fundamental, viz.:

1. Stop.
2. Proceed with caution.
3. Proceed.

The fundamental, proceed with caution, may be used with the same aspect to govern any cautionary movement; for example, when:

- (a) Next signal is "stop."
- (b) Next signal is "proceed at low speed."
- (c) Next signal is "proceed at medium speed."
- (d) A train is in the block.
- (e) There may be an obstruction ahead.

There are two additional indications which may be used where movements are to be made at a restricted speed, viz.:

4. Proceed at low speed.
5. Proceed at medium speed.

Where automatic block system rules are in effect a special mark of some distinctive character should be applied at the stop signal.

The committee therefore recommends:

SIGNAL FUNDAMENTALS.

1. Stop.
2. Proceed with caution.
3. Proceed.

SUPPLEMENTARY INDICATIONS TO BE USED WHERE REQUIRED.

4. Proceed at low speed.
5. Proceed at medium speed.

Stop signals operated under automatic block system rules should be designated by some distinctive mark to be determined by each road in accordance with its local requirements.

The committee also called attention to the fact that a special edition of the Standard Code of Train Rules, which includes the various forms of the several rules which have been in use since they were originally adopted and the interpretations rendered by that committee, had been completed and was issued on March 1, 1911.

A. A. Allen, president and general manager of the Missouri, Kansas & Texas Railway, has been elected a member of the committee to fill a vacancy.

The Committee on Maintenance in its report embodied a summary of replies received to Circular No. 1069 referring to the subject of a standard height for car door fastenings. In that connection, on the recommendation of the committee, the following resolutions were adopted by the association:

Resolved, That car door fastenings should be located normally five feet above the top of rail, but not less than one foot above the floor of the car.

Resolved, That these specifications for the location of car door fastenings shall apply for all new equipment and whenever it is necessary to replace fastenings on old equipment.

The committee also reported that it had considered the undesirability of the use of untrussed wooden brake beams, and presented the following resolution which was adopted by the association:

Resolved, That the Master Car Builders' Association be requested to consider the advisability of adding to the interchange rules that cars with an untrussed wooden brake beam be not accepted in interchange after

some fixed date, and that the matter be referred to the Master Car Builders' Association for such action as it may deem necessary.

The committee referred to the progress which had been made by the sub-committee on the standard dimensions of box cars and standard clearances, and stated that it hopes to be able to report upon these subjects at the fall meeting of the association. A summary of replies to Circular No. 1066 showing the number of freight cars fitted with air brakes and engines equipped with power brakes in use as of January 1, 1911, was embodied in the report of the committee, as follows:

Number of members reporting	325
Freight cars in service	2,129,898
Fitted with air brakes	2,112,853
Not so fitted	17,045
Engines in service	57,340
Equipped with power brakes	57,324
Not so fitted	16
New equipment, other than passenger, under contract or construction—	
Freight cars to be fitted with air brakes.....	34,034
Freight cars not to be fitted with air brakes.....	0
Engines to be equipped with power brakes.....	1,141
Engines not to be equipped with power brakes.....	0

The committee on the safe transportation of explosives and other dangerous articles reported that a hearing had been set by the Interstate Commerce Commission on the subject of the promulgation of regulations for the transportation of dangerous articles other than explosives, to be held at Washington, on Wednesday, April 26. The committee further stated that it had under consideration a number of minor amendments to the regulations for the transportation of explosives, which are to be submitted to the commission before they became effective, after which they will be presented to the association with such detailed rules affecting the duties of employees as may be found necessary.

The report of the chief inspector of the bureau for the safe transportation of explosives and other dangerous articles for the fiscal year ending December 31, 1910, giving in detail the operation of the bureau, was made a part of the report of the committee.

The committee on electrical working reported that it had created three sub-committees from among its members on the following subjects: Third rail clearances, electrical connections and overhead crossings for electric light and power lines, and that all of these sub-committees have done considerable work on the subjects allotted to them.

The committee on relations between railways presented several amendments to the car service and switching reclaim rules which were adopted by the association.

The committee reported that the Interstate Commerce Commission on April 11, 1911, gave the same approval to the association's explanations to the demurrage rules which it had already given to the rules themselves. It also reported that the commission made an addition of a few words to the explanation to Rule 1 of the national car demurrage rules and the association adopted its recommendation that in order to make the explanations of the association identical with those approved by the commission the addition in question be approved by the association. The added words are given in italics:

Cars loaded with company material for use of and consigned to the railway in whose possession the cars are held are not subject to demurrage.

Empty cars placed for loading with company material are subject to demurrage, unless the loading is done by the railroad company *for which the material is intended, and on its tracks.*

The committee referred to the fact that the question of the relations of the operating department to the marking and packing of freight had been referred by the executive committee to it and that, after conference with the general managers' associations of New York and of the southeast, and the Association of Western Railways, the committee had appointed the following sub-committee to consider it: Arthur Hale, chairman; R. M. Patterson (Penn.); H. C. Barlow (Erie); C. H. Ewings (New York Central); J. S. Tustin (Missouri Pacific); J. F. Horrigan (Northern Pacific); H. C. Howe (Chicago & North Western); W. H. Gatchell (Southern); A. C. Kenly (Atlantic Coast Line); W. L. Stanley (Seaboard Air Line).

W. G. Besler (Cent. R. R. of New Jersey) was elected second vice-president; H. E. Byram (Burlington) and J. Kruttschmitt (Southern & Union Pacific Systems), were elected members of the executive committee. The Chicago & North Western and Chicago, Burlington & Quincy were elected members of the committee on transportation. The Baltimore & Ohio, the Cleveland, Cincinnati, Chicago & St. Louis and the Erie were elected members of the committee on maintenance. The Chicago & Eastern Illinois, the Grand Trunk and the Pennsylvania Railroad were elected members of the committee on relations between railways. Benj. McKeen (Vandalia); F. O. Mekher (Rock Island), and J. C. Stuart (Erie) were elected members of the committee on nominations.

The association decided to hold its next meeting in Chicago on November 15, 1911.

MECHANICAL-TRIP AUTOMATIC STOPS.

In our issue of May 5, page 1039, there was a description of the Harrington automatic train stop, together with the results of tests of the apparatus by the Block Signal Board. In reporting those tests the board, making comparisons with ideal conditions, discussed some of the principles of automatic-stop operation as follows:

The apparatus should be so constructed that the removal or failure of any essential part would cause the display of the stop signal and the application of the train brakes.

In any mechanical trip device it is obvious that if the trip is broken off or removed from the path of the engine device which it is intended to engage, it can not act to stop the train. The only means apparently available for insuring the stopping of the train by the absence of the roadside apparatus is to have the engine apparatus so designed as to cause a brake application as the result of the elapse of a certain time interval or the passage of the train through a predetermined distance, unless it received from the roadside apparatus an impulse tending to restore it to the normal running condition. No such system has as yet been presented for the board's consideration.

On account of the delicacy of many essential parts of electrical installations no electrical signal or train-control system could be favorably considered in which the failure of any essential part did not cause a stop indication to be displayed or the brakes applied. With purely mechanical devices, this principle, while no less desirable, is to some extent modified by the fact that such devices may by proper design and the use of suitable materials be made fully as reliable as many other devices in successful use on railways, even though it is well known that the failure of such devices, such as car wheels, steel rails, etc., may cause dangerous conditions.

In the Harrington system, if the weight forming the operative part of the suspension becomes disconnected, it cannot, of course, engage the engine arm. The results of its operations, however, indicate that with proper installation and reasonable maintenance, this device, in spite of theoretical defects, can be made to operate with as high a degree of reliability as many appliances now successfully used.

In like manner to the above, if the engine valve arm becomes bent downward or affected in such a way as to move it out of the path of the suspension, it can not engage the latter to cause a brake application. It is likewise true that many devices are used in railway operation which are more or less susceptible to failure, and which, if absent or out of order, might produce dangerous consequences.

It is believed that while it is very desirable that all devices should be constructed throughout in conformity with the theoretical principle embodied in the characteristic above mentioned, proper design and workmanship will enable devices which do not possess it to be operated with a reasonable degree of safety.

The Harrington air-brake valve is normally held closed by air pressure and is opened by the extension of a compression spring.

The absence of this spring would undoubtedly, and its breakage might very possibly, prevent the opening of the air-brake valve, even though the engine valve arm revolved properly about its axis. There appear to be no great difficulties in the way of redesigning this portion of the apparatus in such a manner as to overcome this objectionable feature, and it would doubtless have to be done to render the device acceptable.

On account of the clearance conditions imposed on the test installation, and in order to secure more ready adjustment of the height of the engine-valve arm, this arm was offset and held at its central portion in a clamped bearing. If this bearing became loosened it would be possible for the middle portion of the engine arm to revolve in its bearing and the ends thereof to be lowered to an amount which might prevent engagement with the suspension. Any installation to be acceptable for service use should use an arm so designed as to overcome this difficulty. It is believed that under most conditions to do so would be entirely feasible. This feature, and the feature of having the valve opened by spring pressure, prevent the engine apparatus from being self-checking of its own failures and can not be improved in the form presented.

It is to be noted that no electrical features whatever are embodied in this system.

INSPECTION OF TRAIN DESPATCHING, SIGNALING, ETC., BY THE BLOCK SIGNAL BOARD.*

From time to time complaints of improper methods of safeguarding train movement have been received, and the board has investigated a number of these. It is encouraging to find that so high a percentage of train despatchers, telegraph operators, signalmen, and trainmen are intelligent, well trained, and faithful. The instances of what appear to be undesirable conditions, which are cited herein, should not be considered as indicating the general practice.

It is believed that one important source of carelessness, lack of skill, inattention to duty, and the use of loose methods on the part of employees in transportation service is due to lack of sufficient supervision and inspection. While in a number of instances the responsible officers were found to have been aware of undesirable conditions, to which their attention was called, and lacked either the courage or energy to correct them, it was more frequently found that the officers in responsible charge were overburdened with detail work and actually unable to give proper attention to inspection, and examination and testing of their men.

GROUP I.

C. & D. R. R.—Investigation indicates that a train despatcher on this road frequently used the following method in making a meet order on single track: Assuming the stations in succession to be indicated by letters A, B, C, D, E, etc., a train at A is ordered to meet a train at D, and a train at E is ordered to meet this train at B. This, of course, constitutes a lap order, but at the same time the despatcher puts out an order at C to hold whichever train arrives first, and makes C the actual meeting point. It is alleged that this practice was the cause of a serious collision on that road, due to the operator at C not displaying a stop signal before taking the hold order.

At the time of inspection electric highway crossing bells at two stations were observed to be out of order and not ringing for the passage of trains. A facing main track switch at another station was observed to have so much lost motion that it could be opened with the foot five-eighths of an inch, head rod, throw rods, and lugs being very loose.

Personnel of offices on this road was found to be very good, and examination on book of rules is rigid. With the form of time orders mistakes are liable to occur. Numbers should be spelled out as well as put in figures. The train-order signal is antiquated and not reliable.

*From the board's annual report. The extracts here given refer to roads in the first four geographical groups.

E. & F. R. R.—At a station on single track the inspector noted that a passenger conductor sent his brakeman to deliver copy of a 31-order to the engineman instead of doing so himself. The brakeman handed it to the fireman on the locomotive, and the order was not compared between engineman and conductor.

In a very busy terminal the telegraphers work in the freight office, in a room where there are several billing clerks, and the operators are continually disturbed by clerks and trainmen. There have recently been two serious mistakes in handling train orders apparently on this account. In general, the operators on this road were found to be efficient and competent.

G. & H. R. R.—Derailing device is antiquated and unreliable. Train was observed to run over a grade crossing of another road without coming to a stop, and this is reported to be common practice on this road. In the case observed the baggage-man at the station gave hand signal to train.

GROUP II.

A. & B. R. R.—Every interlocking plant on this railway was examined and the operation of at least 95 per cent. of all its automatic signals observed in service. An inspection of 21 interlocking plants showed that no rules or special instructions to cover operation of signals at these plants had been issued. Very few of the employees were found to be provided with a copy of the rules governing operation of automatic block signals. This book contains a rule to the effect that a switch must not be opened to permit a movement to the main track when the indicator (that is, the switch indicator provided in the automatic block system) is at stop until protected by flag, as prescribed by the usual rule (Standard Code No. 99). Approximately 400 train movements from side tracks to main tracks were observed, covering a period of four weeks, and in no case could it be found that any attention was paid to the switch indicator. Seventy-five per cent. of the interlocking plants inspected were either not supplied with emergency hand signals, or if provided, the night signals were not in condition for use on account of not being lighted.

The practice in vogue on this road, as regards giving of hand signals at interlocking plants, rather than the use of caution cards, is considered very undesirable.

Many track relays controlling the automatic block signals were found unsealed, and it was observed that signal maintainers made their own adjustments of these relays in the field.

A number of signal maintainers who were questioned said that they prefer to work for this road, rather than to go elsewhere for more pay, for the reason that inspections were infrequent and they were seldom disturbed.

On the occasion of an inspection of this road the division superintendent and several other officers approached a junction on a special train and permitted the train crew, without flag protection, to cross over from one main track to the other and proceed on to the branch after a signal had been cleared for the approach of a train on the main track which was crossed. It is not to be assumed that the rules will be obeyed by the men when such flagrant violations of them are countenanced by their officers. On a portion of this road there are many sidetracks leading by steep descending grades from industrial plants to the main line. Only about 1 in 10 of these side tracks at the time of inspection were found provided with derails.

On a thorough inspection made on this road early in the year conditions as regards personnel of operators were found so flagrant that the matter was immediately brought to the attention of the railway company. An inspection made five months later showed a considerable improvement in the quality of the men, the most incompetent having been discharged and the others instructed. Many men who had never previously been examined on the operating rules had been instructed and examined.

About a mile south of one station on this road two inspectors, riding on a northbound train in such position as to be able to observe the track ahead, saw a trackman flagging the train by waving violently a large red flag. The engineman did not recognize the flag by shutting off steam or blowing the proper whistle

signal in acknowledgment, but proceeded at speed around two sharp curves, where the view is obscured, and on to the station. At this point trackmen were repairing the track. The engineman doubtless assumed that the flag which he passed at unabated speed without acknowledgment was put out by this gang of trackmen, but his failure to acknowledge a positive stop signal was quite on a par with many other features of operation observed on this road.

C. & D. R. R.—On this road a stretch of 31 miles of double track is well protected by automatic block signals, which are maintained in excellent condition, except the lights. The night indications in this territory are exceedingly poor. At the time of inspection three lights were out and many so dim as to be hardly discernible. It is believed that a considerable portion of this trouble can be overcome by adjustment of lamp brackets.

E. & F. R. R.—A freight train on this road was observed switching at an interlocking plant. During the operation the signals on the road on which the train was switching were set at stop position to permit a train on the crossing road to proceed. A trainman continued to give hand signals for a back-up movement, not observing that the fixed signal of the plant was set against him, and 10 cars were backed off the track at the derailing switch, causing considerable detention to traffic.

G. & H. R. R.—At the time of inspection at an important interlocking plant there was no supply of carbon paper and the signalman had to make copies in longhand of messages, one for the engineman and one for the conductor; to avoid extra labor he kept no copy himself. As the inspector entered the tower the second-trick signalman had just had his hand torn and considerably hurt by reason of a switch engine starting up without a signal and mounting the detector bar just as the signalman was moving it to lock a derail. No red or white hand lanterns for emergency signaling were provided. Signalman could not remember when he had a red flag, but did have a yellow one. The plant had been rebuilt, but the manipulation chart and track diagram have not been revised, so that any operator unfamiliar with the plant would be unable, from the chart or diagram, to operate the machine.

One dwarf signal was found that could only be cleared part way, and when partially cleared would not return to the stop position unless the signalman went out and restored it by hand. It was found that this signal could be cleared and the lever then placed normal, and a signal cleared to permit a move in the opposite direction on the same track. There are men assigned to this tower, working tricks of eight hours each, but the second-trick man stated that he had worked both the second and third tricks for five consecutive nights.

At an important yard a switch leading to the main track is controlled by an electric lock from a signal station. No padlock is provided on the electric-lock case, and on the two occasions when inspected the cover was found partly off and in such a position that the lock could readily be "picked" by hand and the switch opened without regard to any control from the tower from which it was supposed to be governed.

GROUP IV.

A. & B. R. R.—Train-order office at C is on the opposite side of track from station, with sidetrack nearly always full of cars, obstructing the operators' view of trains. They have to climb over cars to see if trains are carrying proper signals, if rear end of train clears the block, and to deliver orders. This office should be relocated. At a busy train-order office in a yard at a terminal an operator 18 years of age, with but three months' experience as telegrapher, was found. Copies of his orders submitted by the inspector indicate lack of education and experience for this responsible position.

Of 75 telegraph operators on this road, whose work was under observation for some weeks, 40 were classed as excellent, 10 as good, 20 as fair, and 5 as poor or bad. A number of offices are not equipped with emergency hand signals—that is, flags and lanterns—and in several cases hand signals were not kept lighted at night.

Maintenance of Way Section.

IT is not too late to send in contributions for the track kink contest which closes June 1. A first prize of \$25 and a second prize of \$15 will be awarded for the best two contributions describing devices or methods which have resulted in economy of time or labor, and all other contributions published will be paid for at the rate of \$3 each. There are numerous such devices in use locally, many of which might be considered minor, but whose adoption has resulted in savings. It is such things as these that it is desired to draw out by this competition. Any device which has proved successful in track work will be equally more valuable to some others, and its description will at least be suggestive to all who are working under conditions similar to those under which it has been used.

"HOW the Roadmaster Can Promote Efficiency," will be the subject of the next maintenance contest. There will be given a first prize of \$35 for the best article received on this subject and a second prize of \$20; and for all other contributions that are published will be paid for at our regular space rates. All contributions for this contest must be received by the civil engineering editor of the *Railway Age Gazette*, Plymouth building, Chicago, not later than July 1. The subject suggested is one that every progressive roadmaster has been studying for years. The readers of the *Railway Age Gazette* want to know how *you* have met this problem, if you are a roadmaster, and what results you have obtained. You may have succeeded through the adoption of some new device, a re-arrangement of your forces, closer or more frequent inspection, an occasional gathering together of your foremen for a discussion of time by subjects, or by any one of many other methods. Let us know what you have done, how you have done it, and what have been the results.

IN these days when so many comparisons are being made in all fields of railway work, it must be constantly borne in mind that comparisons of expenditures for maintenance of way must be handled very carefully and with a full knowledge of past expenditures for several years, for there is no department of railway operation which is so subject to the will of the operating executive as is that of track maintenance. For this reason, any comparison between any two years' figures should be regarded with suspicion. When business falls off this is where the first cut in expenses is made, even though the cost of maintaining track to any given standard depends but indirectly on the traffic handled; the effects of such reduction do not appear at once, as is the case in most other departments. It is only after some time that serious results begin to develop, and the operating officer hopes to get his forces back to normal before this time. Whenever retrenchment is on the program, track forces are reduced to a minimum, and this policy is pursued equally in the pruning down of the allotments for rail, ties and ballast, the track being carried over another year wherever possible. When business increases and the forces are returned to normal, additional supplies are necessary to make up for the lack of the previous year and are more readily provided. While this variation is probably necessary from an executive point of view, it tends to demoralize the track forces and foster that spirit, so often exhibited by foremen and roadmasters, of asking for all the material that they think it is possible to secure, as they cannot plan on what they may be able to get next year. The old adage of "a bird in the hand" expresses their sentiments clearly. Owing to the fluctuations in income, it is probable that these expenditures will continue to vary greatly, and as long as they do so the records for several years past must be included in any comparison which is made in this department.

THE *Railway Age Gazette* with this issue establishes a Maintenance of Way Section. Its purpose is to try to help the managements of the railways to increase the economy and efficiency of engineering and maintenance work; and particularly of maintenance work. Perhaps in no other branch of the railway business is the field for increasing economy and efficiency greater than in that of maintenance of way and structures. The total amount spent by the railways of the United States for maintenance of way and structures in the year ending June 30, 1909, was \$308,450,105, which was 19.29 per cent. of the total operating expenses. In the more prosperous year 1907 these expenditures amounted to \$343,544,907, or 19.65 per cent. of the total operating expenses. Owing chiefly, perhaps, to the character of the labor employed and to the rather unfavorable conditions under which its work is done, the maintenance department generally has been in the past regarded as affording fewer opportunities for increasing efficiency than the mechanical and transportation departments, and therefore less attention and effort have been devoted to contriving new devices for and new methods of handling its operations. The main improvements in roadway have taken the form of reductions in grades, elimination of curvature, laying heavier rail, more general use of ballast, etc. The time has come when the engineering and maintenance departments recognize that they have less to hope for from these larger and more striking improvements and more to gain from the smaller and less striking, but more numerous, improvements in the details of their work. It is believed that no technical publication has in the past given adequate study and attention to these more detailed matters. It will be the function of this section to do this; and in doing so it will cultivate a field the soil in which has as yet been only broken. The most effective way in which the Maintenance of Way Section can make itself useful to railway officers is by collecting into its columns, month by month, information about improvements in devices and methods which are being introduced on the various railways; in other words, by constituting itself a clearing house for new ideas regarding engineering and maintenance work. In order to do this successfully it will require the co-operation and assistance of all classes of railway officers who are concerned with such matters. It is gratifying that such assistance already has been received from many sources, and that numerous executive, engineering and maintenance officers have indicated their willingness and desire to co-operate in every way that they properly can. In no way can they do this more effectively than by sending us for publication articles, or material for articles, describing methods or devices that have been, or might be, successfully used for increasing engineering and maintenance economy and efficiency. It is believed that each of those who thus lend their assistance will be further compensated by the benefit derived from the publication of similar information furnished by others.

PROBABLY no recent development in the maintenance of way field offers so much promise of an increase in economy and efficiency, especially for roads with a large proportion of single track or branch line mileage, as does the motor car. For that reason the compilation, given in another column, of the actual results that have been secured with such cars is especially timely in the midst of the flood of efficiency suggestions now coming from numerous sources. The conditions at present are such that improvement in track work must be secured by using all practicable labor-saving devices and thereby reducing manual labor to a minimum. For the purpose of reducing labor to a minimum operating men are giving a great deal of attention to devices for driving spikes, tamping and renewing ties, handling rail and doing many other details of track work. Perhaps the development of labor-saving devices for this kind of work will

be as conspicuous during the next five or ten years as the want of it has been during the past five or ten years. To anyone not closely in touch with the rapid development of the use of motor cars for section forces, the data given elsewhere will come as a surprise, chiefly because of the uniformity of the success obtained and the definiteness of the results secured. Those roads which have put in service the largest numbers of cars have, as a rule, got the best proportionate results. With their greater experience, they have developed means of inspection and repair that have increased the effectiveness of the cars and reduced the danger of accident and the complaints about their unreliability. After using them a short time the men prize them, and take fewer chances with them than with the hand cars, knowing that if their motor car is hit by a train they will have to go back to the hand car. The objection of unreliability is based very largely on experience with the motor car of 10 or 15 years ago, and does not take account of the great development of the motor within the past five years, due largely to the rapid progress of the automobile industry. The report of the performance of 31 cars on the Seaboard Air Line in March of this year is an excellent argument for their reliability; the total delay they caused being but $4\frac{1}{2}$ hours, and this being caused by two cars. Of course, there will be difficulties connected with their operation, especially just after they have been put in service, but these difficulties will usually in the long run be much more than compensated for by the many advantages which will be gained. To be a success, the cars must have the enthusiastic support of the roadmaster or supervising officer on whose division they are used, and he must exercise patience in training the foremen to operate them. A certain amount of prejudice is to be expected regarding any new development, but the almost uniform experience of the roads has been that after the men become acquainted with the cars they will not willingly return to the old hand cars. There are certain minor shortcomings in the construction of the various types which require remedying, and there is still room for development in a number of details; but, generally speaking, the future of the motor car is perfectly secure.

TIE ECONOMY.

NOW that track forces are largely engaged in renewing ties it is worthy of noting that there is no more fruitful field for economy in maintenance expenses than in tie renewals, this being the largest single item of cost in track maintenance. It is apparently more neglected than any other item, largely because it requires constant and immediate supervision to prevent the removal of good ties, while in other details of track maintenance, such as changing rail, angle bars, and ballast, there is not the necessity for such close supervision.

It is only natural that if the choice of ties to be renewed is left to the section foreman himself he will use all the ties he can get unless it is made to his interest to save them. Thus ties are frequently taken out of track which would have given several years more service. After removal it is too late to tell by inspection whether they should have been left in the track or not, as they are generally split and injured in removal. A section foreman, who was replacing a string of perfectly good ties with new ones, in answer to why he was taking out the good ones, replied that he "had the new ones on hand and wanted to use them up." This is typical of the attitude of most section men and of many supervisors or roadmasters. The difficulty of obtaining a sufficient number of ties in certain years makes the men wasteful of them in other years when ties are more plentiful.

Under no circumstances should ties that are badly decayed be left in the track, for this is not true economy. When it becomes necessary to renew a large percentage of ties in any one season, it is usually because they have been neglected, and as a "stitch in time saves nine," so a tie in time may save others

by giving them the added strength necessary to maintain their life. Naturally a high-speed track with heavy traffic requires better ties than a track with few and light trains, but it does not necessarily follow that it requires more frequent renewal of ties than the latter track, for the question of tie renewal is one of decay of the tie, and on a fully ballasted, well-drained track, the decay will not be as rapid as on a track with mud roadbed and poor drainage.

The maintenance officers should decide on the standard of track desired and the supervisors, and through them the section men, should be educated in the best methods of maintaining the track to this standard at the minimum expense for ties for a series of years rather than for one year. This education should include the proper time for renewal, the proper caring for ties by piling and seasoning, the proper places to use hard, soft and treated ties, and where second-hand and cull ties may be used for temporary or light traffic tracks. The proper use of tie plates should also be studied, and the kind of ties on which they are most needed. Ties should be put in early in the season and not left until just before winter. Track should be properly drained so that the ties are not subject to wet and dry exposure, shims and braces should not be used unnecessarily, and, above all things, spike killing should be avoided. In relaying rail, spike holes are not always properly plugged, and spikes are often re-driven more frequently than is necessary. Four rows of spikes are sometimes pulled when only three or even two would be enough. Frequently track is ballasted and afterwards rail relaid, making it necessary to move the ties a second time in order properly to fit the joints of the newly laid rail. Ballast or dirt is unloaded on the tops of the ties and left there, keeping them wet for a long time.

All these things are seen on first-class roads which are supposed to have competent supervision, and until this matter is given the consideration which its importance deserves the expenditures for ties will continue to be excessive. Detailed and thorough reports should be made and then used. As compared with the study of rail, too little inspection is made concerning the failure of ties. To be sure, there is not the immediate danger as an incentive, but the question of cost and economy of maintenance is greater in the case of ties than of rail. Continuous study should be made of every mile of road, for it is detailed investigation and direction that is needed. It is easy to give orders to *save ties*, but it requires supervision to see that they are used in a truly economical manner.

ENGINEERING ARTICLES SINCE APRIL 1.

THE following articles of special interest to engineers and maintenance of way men, and to which readers of the engineering and maintenance of way number may wish to refer, have appeared in the weekly issues of the *Railway Age Gazette* since April 1:

Retaining Wall for the Milwaukee at Elgin.—J. H. Prior, assistant engineer, C. M. & St. P., describes an unusual condition and a novel type of retaining wall designed to meet it, giving results of a comparative study of five types of wall with yardage and cost of each. April 7, page 826.

Efficiency Committees on the Chicago & North Western.—The committee organization adopted by the Chicago & North Western to encourage employees in the maintenance of way, mechanical and transportation departments, in increasing the efficiency of "men, materials and machinery," is described on page 892 of the issue of April 14.

The plan announced by the Rock Island, of offering premiums for efficiency of roadmasters and section foremen, is outlined on page 830 of the issue of April 7, and an editorial commenting on these and other methods of increasing efficiency in track labor appears on page 819 of the issue of April 7.

American Civil Engineers' Pocket Book.—Review of a new pocket book edited by Mansfield Merriman. April 14, page 893.

A Defense of the Committee Work of the Engineering Association.—Letter from J. L. Campbell, engineer maintenance of way, El Paso & Southwestern, referring to editorials in the daily edition during the American Railway Engineering Association convention. April 14, page 897.

The Burlington's Entrance into the Southern Illinois Coal Fields.—

The Burlington's reasons for entering Southern Illinois and the engineering features involved in the reconstruction are given in an illustrated description on page 900 of the issue of April 14.

Mannheim (Chicago) Yard; Chicago, Milwaukee & St. Paul.—The Chicago, Milwaukee & St. Paul has built a large classification yard, having 44 tracks leading from one hump. The design and construction of the yard is described in the issue of April 14, page 903.

Rebuilding the Salt Lake Route.—The flood of January, 1910, washed out 29 miles of track on this road, requiring a relocation. The article on page 937 in the issue of April 21 touches on the interesting features of the wash-out, brings out the problems that confronted the engineers in rebuilding the line, and describes the methods used in meeting these problems.

Sewall's Point Terminal; Virginian Railway.—The yards and wharf which the Virginian has built at Sewall's Point, Va., for the rapid handling of bulky freight, are described on page 951 of the issue of April 21.

Editorial note on keeping permanent records of side tracks. April 28, page 975.

Editorial note on effect of rate of pay of section foremen on efficiency of track work. April 28, page 975.

Track Formulae and Tables.—Review of book by Shelby S. Roberts, presenting common track problems in a practical way, including time-saving tables for use in estimating. April 28, page 977.

Erection of the Kentucky River High Bridge.—H. H. Starr, assistant engineer of the American Bridge Company, describes the erection methods found necessary in rebuilding the C. N. O. & T. P. bridge at High Bridge, Ky. The bridge that is being replaced was the first cantilever bridge built in this country. The site is the same as that chosen for a suspension bridge in 1854. April 28, page 980.

Concrete for Railway Work.—An abstract of a paper discussing the use of concrete for railway work is given on page 997 of the issue of April 28. A list of types of railway structures built of concrete is a part of this abstract.

Report on Condition of Treated Ties on Gulf, Colorado & Santa Fe.—The latest results of the extensive tests on treated ties being made under the direction of the Bureau of Forestry of the U. S. Department of Agriculture are given on page 999 of the issue of April 28.

A complete list of the committees of the American Railway Engineering Association and the subjects assigned them for consideration during 1911 are given on page 1005 of the issue of April 28.

Corrosion and Protection.—The railways consume nearly one-third of the total production of steel in the United States in rails, structures and cars, and have made considerable progress in properly protecting this metal from corrosion. An editorial discussion of the subject appears on page 1025 of the issue of May 5.

Bridge Replacement on the Boston & Albany.—The Boston & Albany has replaced several bridges by building the new structure alongside the old, coupling the two together, drawing the old one out and the new one into place. The actual operation occupies from 35 to 50 seconds and the time required between the last train on the old bridge and the first one on the new averaged about 1¼ hours. An illustrated description of the work is given on page 1034 of the issue of May 5.

Necessity for the Use of Track Scales in Timber Treating and the Results to be Obtained from Their Use.—Abstract of appendix F to the report of the committee on wood preservation, presented at the annual meeting of the American Railway Engineering Association. May 5, page 1040.

Grade Revision and Terminal Work on the Chicago Great Western.—The economic and engineering features of the improvement work on the eastern division of this road are described on page 1108 of the issue of May 12.

Replacing Steel Viaducts on the Bessemer & Lake Erie.—This article describes the replacement of a viaduct 240 ft. long with a double 26-ft. concrete arch. One barrel was built about the legs of one of the steel towers, requiring the blocking up of the viaduct on the finished concrete arch before the steel inside the barrel could be cut away. May 12, page 1116.

NEW BOOKS.

Field Book for Railroad Surveying. By Charles Lee Crandall, professor, and Fred Asa Barnes, assistant professor, of railway engineering at Cornell University. New York: John Wiley & Sons. Morocco, 202 pages, 4 in. x 6½ in. Price, \$2.

This book is the outgrowth of the notes which have been prepared by the authors from time to time to supplement the textbooks on railway surveying used in their class rooms, combined with the Crandall's Transition Curve, which appeared previously as a separate book. The authors have left out many of the special problems, but seldom met with in practice, and endeavored to include only those more commonly encountered, and to connect these with practical conditions. Sufficient tables are given for all the ordinary requirements of the engineer in the field.

MOTOR CARS FOR SECTION FORCES.

The problem of the maintenance of track by ordinary section labor is becoming more serious each year because of the continually decreasing efficiency of this labor. There seems no prospect of securing a better class of laborers; officers must get the best results with the labor available. Two ways suggest themselves: One is that of raising the standards of the men themselves; the other, that of reducing the manual labor to be done to a minimum by the use of mechanical devices. The prize and bonus systems and the educational courses provided by different roads aim at the first result, while the use of motor cars is an important development toward the second end.

While motor inspection cars have been used for ten or twelve years, the motor car for section forces is a comparatively recent development. The first of them were put in service but little over five years ago, and it is within the last two years that the most rapid development of their use has taken place. As widely diverging views exist among railway men concerning the advisability of their employment, the *Railway Age Gazette* wrote to the presidents of all the railways in the country over 500 miles long (49 roads in all), to find out the actual number of cars in use and the results that have come from their operation. Replies were received from 41 roads. In this letter the following information was requested:

1. How many of each kind of cars, as, for example, section cars, inspection cars, etc., has your road in service?
2. Kind of service?
3. Name of maker?
4. Period of time in service?
5. Cost of repairs and method of keeping cars in repair?
6. Cost of fuel per car per month?
7. How much have you been able to lengthen sections and what has been your relative saving in labor?
8. Do you secure greater efficiency from your labor?
9. Remarks concerning relative economy and efficiency, especially as compared with hand cars.

The replies received to this circular letter have been tabulated and are given in the accompanying table. It will be noted that a number of the roads are using the motor car for section forces to quite an extent, while a large number are experimenting with it.

Although the primary object of the investigation was to learn the results of the use of the car for section work, the replies relative to light inspection cars are interesting. While nearly all who commented on the use of inspection cars heartily approved of them, a number of the roads do not use them at all. The frequency of accidents while using such cars has created a prejudice against them in many quarters. This danger emphasizes two things; first, that motor cars either for inspection or section purposes are not equally advantageous everywhere; and, second, that their use may be abused either by careless disregard of trains or by running at too high rates of speed.

Referring to inspection cars for the use of the roadmaster, several roads said that with them greater efficiency is secured from the gangs because the roadmaster is enabled to be among them more and keep in closer touch with their work, this being especially true on branch lines where the train service is infrequent. Also, in this connection, the old practice of section gangs taking the roadmaster over their sections, with the resulting inroads on their time, is abandoned, and in addition he is enabled to cover more territory in a day.

A rapidly growing field for these light inspection cars is being created by the installation of automatic signals requiring regular inspection. In the signal department alone the Norfolk & Western has 70 of these cars, and officers of this road estimate that the resulting saving in labor has been 25 per cent., while the increase in efficiency has been 50 per cent.

Strong opposition to the introduction of the motor car for section work is apt to be met at first. Many foremen will oppose it because they realize that it means a reduction in their number. Also, there exists in many cases a strong dislike to anything different from what the men have been accustomed to, and it is difficult to secure a fair trial. The cars are certain to get

USE OF SECTION AND INSPECTION MOTOR CARS.

Name of Road.	No. of Cars.	Kind of Service.	Maker.	Length of Time in Service.	Cost of Repairs Per Month.	Method of Keeping Cars in Repair.
A., T. & S. F.....	99	Section ...	F. M. Co.....	Max. F. M. Co., 5 years.....	Section, \$7.50-\$10..	Light repairs by traveling repairman; heavy in shop.
	75	Inspection	Autrakar	Max. Autrakar, 3 years		
Baltimore & Ohio	6	Section ...	F. M. Co.....	Max. 2 years	Minor repairs only.	Light repairs by foreman; heavy in shop.
	27	Inspection	4 F. M. Co.....	Max. 7 years.		
			2 Rockford			
Bangor & Aroostook....	2	Inspection	F. M. Co.....	1-10 years; 1-4 years.....	Average \$2.12....	
Buffalo, Roch. & P.....	0					
Chicago & Alton	2	Section ...	F. M. Co.....	3½ years	\$1.67	Light repairs by local machinists..
	2	Inspection	F. M. Co.....	10 years .....	.88	
Chicago Great Western .	65	Section ...	Rockford	Max. 1 year	\$1.85 to \$2, mainly for batteries.	
	12	Inspection	Hendrix			
			F. M. Co.			
Chicago, Ind. & L.....	1	Inspection	Buda	1 year	Minor repairs only.	Repairs made by user.....
Chicago, Mil. & P. S....	27	Section ...	Rockford	4 months	\$1.50	
			23 Rockford			
			4 F. M. Co.			
C., M. & St. P.....	195	Section ...	Rockford and	Over 2 years		Inspector makes light repairs; heavy repairs in shops.
	93	Inspection	F. M. Co.			
C., R. I. & P.....	41	Section ...	Rockford	Max. 5½ years	Section \$2.37	Light repairs on ground; heavy repairs in shop.
	75	Inspection	F. M. Co.			
			Buda			
C., S. P., M. & O.....	8	Section ...	Adams			
	5	Inspection	Rockford	8 months	\$1.18	Light repairs on ground; heavy in shop.
Colorado & Southern...	9	Section ...	F. M. Co.....	Max. 5 years	5.00	Light repairs by foreman; heavy in shop or by manufacturer.
	8	Inspection	F. M. Co. and	10 months	\$1.50	
			Rockford	1½ years.		
Del., Lack. & Western..	0					
Denver & Rio G.....	2	Section ...	F. M. Co.....	Max. 9 months	No repairs but batteries and spark plugs.	
Detroit, Toledo & Ir....	0					
El Paso & S. W.....	2	Section ...	Buda	2 years	\$5.83	Foreman makes minor repairs under instruction of motor car mechanic; heavy repairs in shop.
	4	Inspection	F. M. Co.....	4 years	Minor repairs only	Repairs made by users.....
Erie	2	Section ...	18 F. M. Co.....	4 months to 8 years	\$1.80	
	29	Inspection	4 Rockford			
			8 Buda			
			1 remodeled			
Florida East Coast	1	Inspection	F. M. Co.....	18 months	\$1.33, mainly for front tires and spark plugs.	
Great Northern	52		H. K. Harrison...			
			F. M. Co.			
			Oldsmobile			
			Buda			
			Adams			
Gulf, Col. & S. F.....	5	Section ...	7 F. M. Co.....	Section, 3 months to 1 year..		Inspected monthly by mechanical dept. Light repairs made by users; heavy repairs in shop.
	8	Inspection	5 Autrakar	Inspection, 4 years to 8 years.		Repairs made by users.....
			1 Kalamazoo			
Int. & Gt. No.....	6	Section ...	F. M. Co.....	11 months	\$1.40 to \$6.00....	
	8	Inspection	F. M. Co.....	18 months.		
K. C., Mex. & Orient...	0					
Kansas City Southern...	0					
Lehigh Valley	7	Inspection	2 Buda	6 months to 3 years.....	No heavy repairs necessary.	Users have made light repairs...
			5 F. M. Co.			
M. & St. L.—Iowa Cent.	0					
N. C. & St. L.....	1	Section ...	F. M. Co.....	15 months	Section \$0.86	
	2	Inspection	F. M. Co.....	Max. 2 years.		
New York Central Lines	14	Section ...	F. M. Co. and	Section, 4 months to 2 years..	\$2.08	
	135	Inspection	Rockford.....	Inspection, 1 to 12 years.		
Norfolk & Western	25	Section ...	7 Rockford	Average 2½ years.....	\$3.50	Repairs in shop.....
			10 Buda			
			8 F. M. Co.			
	86	Inspection	66 Buda	Average 2½ years.....	\$2.25	Repairs in shop.....
			20 F. M. Co.			
Pennsylvania Lines West	0					
Pere Marquette	3	Inspection	F. M. Co.....	Max. 3 years.....	No record	Repairs in company shops.....
Philadelphia & Reading	0					
Queen & Crescent	9	Inspection	Buda and	Max. 9 years.....		
S. P., L. A. & S. L....	15	Inspection	F. M. Co.....	Max. 7 years.....	No record	
			12 F. M. Co.....	Max. 1 year		
			3 Buda			
St. Louis & San Fran.*.	30	Section ...	F. M. Co.....	Max. 2½ years.....	\$3.50	Repairs by motor car inspector...
Seaboard Air Line.....	20	Inspection	16 F. M. Co.....	6 years	No data.	
			4 Rockford			
Southern	27	Section ...	27 F. M. Co.....	Section, max. 16 months.....	No data yet available.	
	7	Inspection	3 Buda	Inspection, 6 years.		
			4 Rockford.			
Terminal R. R. of St. L.	2	Section ...	6 F. M. Co.....	5 months to 1½ years.....	Very light	Made by car repair dept.....
	5	For bridge and car repair dept.	1 Rockford			
		gangs.				
Union Pac.—So. Pac. Sys.	94	Section ...		1 to 4 years.....	\$0.80 to \$2.00....	Minor repairs by users; heavy repairs in shops.
	144	Inspection				
Wabash	4	Inspection	3 F. M. Co.....	4 years	No record	
			1 Buda	1 year.		
Western Maryland	0					
Wheeling & Lake Erie..	5	Inspection	2 F. M. Co.....	Max. 6 years.....	Very light	Repairs by users.....
			3 Rockford	16 months	Moderate.	

NOTE.—"F. M. Co." refers to all Fairbanks, Morse & Co. and Sheffield cars. "Rockford" refers to all Rockford and Duntley cars.
 *Recently installed a few section cars. No record yet available.

USE OF SECTION AND INSPECTION MOTOR CARS—(CONTINUED).

Cost of Fuel Per Car Per Month.	Amount Section Lengthened. Relative Saving in Labor.	Is Efficiency Increased?	Remarks.
F. M. Co. No. 14, \$2.43. Autra \$1.80 F. M. Co. No. 2J, \$1.35 Section \$8.50	Consolidated two sections in one. New section 10-13 miles long.	Yes	Facilitates bunching section gangs for small improvements, washouts and wrecks. Use should be confined to branch lines of light traffic. Little saving on heavy traffic main lines with short sections.
25 mi. per gal. gasoline. \$1.20 (batteries \$1.50).. 28 mi. gal. gasoline. \$1 to \$4.....	Lengthened 6 or 7 mi. New sections 11½ and 14 mi. long. Labor saving, one-third. Lengthened from 6 mi. up to 10 or 12 mi. Labor saving, 42 per cent. in winter, 23 per cent. in summer.	(See "Remarks") Yes	During working season poorer results secured with motor cars on 12-mi. section than with same number men with hand cars on two 6-mi. sections, account numerous motor car failures. Section men in better physical condition for starting work.
30 mi. per gal. gasoline. \$3.50	Lengthened 5 mi. Saving, 50 per cent.....	Yes	No definite conclusions as to merits account short service and extreme weather conditions.
Average of 25 cars shows .034 gal. gasoline and .012 pints valve oil per mi. run. Section \$2.30	Increased 40 per cent. to 100 per cent.....	Yes	Danger of striking motor cars less than hand cars because motor cars cover a certain distance in so much less time that they meet or are passed by fewer trains.
Section \$3.25	Lengthened section 3 mi. Annual saving per car \$691.22. Labor efficiency increased 18 per cent.	Yes	Decreased time to and from work 60 per cent.
Insp. \$0.60 per 100 mi. \$3.97	Lengthened 7 or 8 mi. Saving labor \$4.72 per mile per month. Lengthened by 5 to 6 mi. Six gangs replace ten.	Yes Very much	Use of motor cars tends to secure and hold better class of laborers. More hours work, less on road, easier to secure men. Can use on grades where hand cars cannot be operated. In emergency can send men greater distance.
30 gal. gasoline; 3 gal. lubricating oil. Section \$4.50	No change on main line. Four sections combined in one on branch. Saving \$90 per month on branch. Sections increased to 31.7 and 35.7 mi. Save 6 men's labor.	Yes Yes	Economy lies in saving time to and from work and the fact that laborers are not fatigued from pumping car. Fifteen per cent. saving account less time to and from work. Also saving in wages account decreased force.
\$2	No increase. But little if any saving in labor.	Yes	Section cars have not been used sufficiently to show any material economy or increase in efficiency.
60 mi. per gal. gasoline. .....	.....	.....	Car run between 10,000 and 15,000 miles. Never walked in. Greater efficiency conceded as employees cover greater territory.
\$4.20, or \$0.70 per 100 m \$5 for gasoline.....	100 per cent. increase. Reduced labor one-third. Lengthened sections 13 mi. New sections 23 mi. long. Two motor cars replace 5 hand cars. Saving 50 per cent.	Yes Yes	Not considered desirable to use gasoline cars where there are a number of curves and deep cuts or where volume of traffic is heavy. Average time at work increased 2 hrs. a day. If cars continue present record, will increase efficiency of labor and supervision 25 per cent. and decrease cost of section maintenance 50 per cent.
\$4 to \$4.50.....	.....	Yes	Greater efficiency secured in track work due to more frequent and better inspection of gangs and track.
Section \$1.85 gasoline.. .31 lubricants.	No increase in length. \$20 a month saving in labor.	Yes	Cost of car \$0.01 a mile General overhauling and interest on investment..... .01 " Gasoline ..... .005 " Cost of batteries, light repairs, lubricating oil, wire, etc.... .005 " Motor cars, when used for transporting bridge, interlocking and paint gangs, have proven both economical and efficient. They are hardly successful on lines of great density of traffic where they have to be operated under train orders.
\$1 to \$5.....	No increase. On certain lines, able to reduce forces.	Yes	With motor cars labor can be obtained at points where it is almost impossible with hand cars. Signal department estimates increased efficiency 50 per cent.
\$5.90	(Two divisions) doubled length. Saving labor \$61 each.	Yes	
\$3.60	(One division) no change. Saving labor 25 per cent. (One division) 3 sections made 2. Saving labor \$61.	Yes	
Section \$3.00	Lengthened by 4-6 mi. one branch.....	Yes	Experience more than filled expectations. Cars can be successfully used on light traffic branches having practically no extra trains.
Averages \$3 per month.. \$3.50	Lengthened by 6-10 mi. very light branch. Two 5-men gangs replace three 4-men gangs. Doubled length of sections from 7 to 14 mi. Dispensed with 20 foremen. No increase. Labor saving 10 to 15 per cent.	Yes Yes	Section motor cars are giving satisfaction. Foremen recognize their merit. On light lines where road is reasonably straight and cars intelligently used they are a distinct benefit. Men go to work on their own time, thereby putting in full time on the track.
\$2.50 to \$4.....	Some districts not lengthened; others lengthened 3 to 15 mi. Savings \$1 to \$11 per month.	Yes	Use not sufficiently general to admit of relative comparisons.
\$1.00 per 100 miles.....	.....	.....	Roadmaster able to inspect sections more frequently, thereby increasing efficiency of section forces. Section men not required to pump car over section to carry roadmasters.

out of adjustment and prove somewhat unreliable when operated by men who are entirely unfamiliar with anything of the kind. To obtain the best results from their use it is essential that their adoption have the hearty support of the roadmaster or official in charge, and judgment must be exercised in deciding where they shall first be employed. As with any appliance, they can be used to greater advantage under some conditions than under others. It has not yet been proven that they are desirable on three- or four-track lines, where sections must be short and where trains are frequent. Some roads are using them with success on double-track lines, while others question their desirability on such lines. Also, many say they are not advantageous on lines of heavy curvature.

Probably one of the greatest objections to the use of the car is the danger of breakdowns and delay. One officer reports that "during the working season we can get better results and accomplish more work with two hand car gangs located near the center of six-mile sections than with the same number of men on a 12-mile section with a motor car, on account of so many failures to a car, especially when in charge of a new foreman who does not fully understand operating it. When the car fails with a large gang of men going to or returning from work the expense counts up." On the other hand, it is interesting to note in this regard that on the Dakota division of the Northern Pacific records kept of the performance of three motor cars for four months last summer showed an average delay of but 32 minutes per month on account of the motor, with an average monthly mileage of 507. In many instances delays are largely over-estimated owing to past experience with the earlier types of power cars, for a great development has taken place in the past few years, and the cars are being continually made more reliable. These delays are also decreased as soon as the foreman begins to understand his car so that he can readily locate and remedy any minor trouble.

The manner of making repairs on the various roads depends mainly on the number of cars in service. Where but a few are being used the general practice is to depend on the individual foremen to keep them in order. The general report shows that no unusual difficulty has been met under this method, and the cost of repairs averages close to the cost where more elaborate methods are used. The El Paso & Southwestern sends a motor car mechanic to inspect thoroughly each car every 60 days and to instruct the foremen in making light repairs. Where a large number of cars is used, the Santa Fe, the Seaboard Air Line and the Milwaukee employ an inspector who travels back and forth keeping all the cars in order. This works out economically and gives greater reliability by insuring that adjustments will be made by an experienced mechanic.

Although the results given are from roads operating in all parts of the country, and under widely differing conditions, the letters say, almost without exception, that the use of the cars has increased the efficiency of track work. With a motor car the men are able to go to and from work in much less time than with a hand car and are fresh on arrival at their work, this being most important on lines of heavy grades. The Colorado & Southern is using motor cars on grades up which hand cars could not be pumped. The elimination of this hand car pumping often enables a road to get a better class of men. The Norfolk & Western reports being able to secure men at points where it was almost impossible to get them when using ordinary hand cars, while the Omaha road reports that in addition to securing a better class of men it is enabled to hold them longer. The almost universal result of the use of motor cars has been an increase in the length of sections and a decrease in the labor necessary. The lengthening of the section has reduced the cost per mile for the foremen, and the general result has also been that a reduction in labor has been possible, owing to the workmen being able to spend more hours on actual track work. On unimportant branch lines the saving has been most marked. On the Denver & Rio Grande in one instance four sections were

combined into one and better results were secured on the one long section than on the four short ones. On the El Paso & Southwestern it is made practicable, by the use of these cars, to maintain two sections 31.7 and 35.7 miles in length, respectively. The greater the length of the section, the greater, of course, is the advantage over the hand car, since the labor involved in going over the section is in proportion to the mileage.

The value of the car in emergencies is worthy of consideration. In cases of serious storms, wash-outs or wrecks, employees can be collected from a large radius in a short time; without the motor cars, trains would have to be called out to collect the men. The instance reported by the Chicago, Milwaukee & St. Paul, when, following a heavy thunderstorm, one division of 140 miles was thoroughly patrolled and traffic resumed in 20 minutes after the firemen were called out by the dispatcher, illustrates this point. This greater facility for collecting larger forces is an important factor in making small improvements where otherwise it would be necessary to call out an extra gang. In sparsely settled parts of the country it has been necessary for the railways to provide dwelling houses for the foremen, and the foremen, in turn, provide board and lodging for the men. Under such conditions, it is very hard to hold the men, but with motor cars the range for selection of headquarters is increased. Where Italians or Greeks are used for section laborers it is often hard to get them to work in small gangs, owing to their mode of living. With a motor car, some roads have lengthened sections sufficiently to use large enough gangs to remove this difficulty.

Such cars are of special advantage for bridge gangs, whose work is scattered over the entire division. Under the common method, the movements of such a gang depend on the way freight is moving from one place to the next. When one piece of work is completed the men have to wait until a train comes before they can go to the place of the next job, while with the motor car they can proceed immediately, with an interval of probably an hour between the jobs instead of a half day or more. By the use of motor cars the Colorado & Southern increased its bridge territory 20 to 30 miles per gang.

It is interesting to note the support given to the cars by the men after they have become accustomed to them. In many cases, after using them for some time, they will refuse to work on hand cars.

The experience of the Terminal Railway Association of St. Louis is instructive. With the cars the men are willing to go to their work on their own time, and are thus enabled to put in a full day on the track.

The increase in efficiency is estimated by various roads up to 25 per cent, while the saving in labor in some cases has been estimated as high as 50 per cent. The Chicago Great Western reports that it has reduced its labor on a winter basis 42 per cent., and on a summer basis 23 per cent. On the basis of these estimated savings, it does not take long for a motor car costing about \$200—as compared with \$35 for a hand car—to pay for itself. Consider, first, the reduction in the rate per mile of the cost for foremen. With a six-mile section and a wage of \$50 a month for a foreman, the monthly rate per mile is \$8.33, while with a section lengthened to nine miles and the foreman's pay increased to \$60, as some roads have done, the rate per mile falls to \$6.67, a decrease of \$1.67 per mile, or of \$15 for the section, an amount about twice the average monthly cost of fuel and repairs for the car. This is in addition to the better results obtained with the higher class of foremen secured by the higher rates of pay and by the weeding out of the poorer ones when the number is reduced. Again, consider the saving in time spent going to and from work. If one hour a day is saved, this means a saving of 13 days' labor a month for a gang of five men, or, at \$1.50 a day, \$19.50 a month, an amount sufficient to pay for the car within less than a year. A number of roads have made savings far in excess of these figures, as is shown in the report. In an article published in the *Railway Age*

Gazette of November 18, 1910, describing the service of three motor cars on the Dakota division of the Northern Pacific, it was shown that these cars more than paid for themselves in four months.

In addition to the two savings computed, the other advantages of using motor cars, such as the freshness of the men on arriving at work and the emergency value of the car, also result in important economies the actual amounts of which cannot be computed.

We give below the experiences of the Seaboard Air Line and the Norfolk & Western in more detail, as furnished us by officers of those roads.

EXPERIENCE OF THE SEABOARD AIR LINE.

We have on this system quite a number of light traffic branch lines from 20 to 75 miles in length, on which there is very little variation in the traffic, and on which it is quite out of the ordinary to run any but scheduled trains. The advisability of using motor cars for sections was investigated during the summer of 1908, and we decided to try a few so as to determine their desirability by actual experience. The first three of these cars were put in service in September of that year; one on a branch 20 miles long, on which there were two sections of 10 miles each; one on a branch 30 miles long, on which there were two sections of 15 miles each; and the other was on a branch 20 miles long on which there were two sections of 10 miles each.

The traffic over each of these branches consisted of one mixed passenger and freight train each way per day. Before installing the motor cars, we paid the foremen \$45 per month and furnished them houses free of rent. Each 10-mile section was allowed an average of four men, and the 15-mile sections were allowed an average of six men each. After installing the motor cars, we cut off three foremen and allowed six men each for the sections on the 20-mile branches and eight men on the 30-mile branch, and also increased the wages of the foremen we retained to \$50 per month. Below, I give comparative labor costs:

	Foremen.		Laborers.		Total.
	No.	Wages.	No.	Wages.	
With hand cars...	6	\$270.00	28	\$700.00	\$970.00
With motor cars..	3	150.00	20	500.00	650.00

This shows a net saving of \$320 per month, from which must be deducted the cost per month of operation of and repairs to motor cars, which we find average about \$4 per month for repairs and \$3.50 per month for fuel, a total of \$7.50, giving a net saving of \$312.50 per month.

These cars were placed in charge of men who had never seen a gasoline engine, and the only tutoring they had was from a man sent out by the makers of the cars to set them up. This man spent one or two days with each foreman.

The greatest trouble we have had with our motor cars is from insignificant things, such as wire troubles and weak batteries. It did not take the foremen long to catch on to the wire troubles, but the weak batteries were a different proposition. To overcome that we furnished with each car an ammeter, to test the batteries, and we soon found that this made a saving in our battery bills.

We also found that we were saving a great deal in the time consumed in going to and from work. Before the motor cars were installed, an average of 1½ hours per day were consumed by each of these gangs in going to and from work, while with the motor cars the average was only 45 minutes per day; therefore, the average actual time worked on track when hand cars were used was 8½ hours per day, and with motor cars 9¼ hours per day. We also found that in hot weather when the men pumped a hand car out to their work, they were tired and hot before they had really begun it, and they would begin to think of the long hot drag they would have in going home in the evening; consequently they would begin to rest up so as to be ready for their home journey. With the motor cars, they

arrive at their work fresh and cool, and they know when they have finished their day's work on the track, they will have a rest going home.

After testing out the three cars referred to for six or eight months, we were satisfied that we could save money by using them, and we have now installed them on 31 sections, some of which are on branch lines where the traffic is much heavier than on the three branches above described. As near as I can figure, these 31 cars save us \$20,000 per year in labor, and in every instance there has been a marked improvement in the track.

As to the influence of motor cars in holding labor, there is no question but what it is a great aid, especially with our negro labor in the south; for if there is anything that a negro likes it is to ride and not have to work while doing so. We had a case on one motor car section where the car had to be sent in for repairs, and every man quit and refused to pump a hand car, but as soon as the motor car was returned every man came back. The foremen at first showed some prejudice against the use of motor cars on account of not wanting to see other foremen discharged; but when they found that we had fully determined to use the cars, they changed their minds. One foreman I have in mind had a brother on the adjoining section, and he objected very much to his brother being let out, but when he found that he would have to operate the car or that both he and his brother would be out of a job, he soon came around; and he has since told me that if he had to use a hand car again he would quit railroading.

To sum up, we feel that our experience with motor cars has been entirely successful, and now that we have sufficient cars in service to warrant having a motor car repairman to look after them, we will get even more satisfactory results.

We have a record kept of the cost of operating each car each month, which is tabulated in the attached table. This record has demonstrated that some men use very much more fuel than others, and one of the duties of our motor car repairer is to handle such cases so as to get better results.

SECTION MOTOR CAR PERFORMANCE—SEABOARD AIR LINE—MARCH, 1911.

Div.	Sec.	Minutes Delay.	Gasoline.	Other Supplies.	Repairs.	Total.
1st	14 00	\$2.99	\$0.72	\$0.00	\$3.71
1st	*15 00	1.73	.32	.00	2.05
3rd	40 00	1.43	.27	.00	1.70
4th	1 120	1.80	.00	.00	1.80
4th	2 150	2.40	1.12	.48	4.00
5th	41 00	2.22	1.79	2.14	6.15
5th	42 00	1.98	1.99	.97	4.94
5th	43 00	2.40	2.23	.00	4.63
5th	44 00	1.80	.37	.00	2.17
5th	51 00	2.28	1.96	10.50	14.74
5th	52 00	1.44	1.83	6.70	9.97
5th	53 00	1.44	1.15	3.76	6.35
5th	54 00	3.48	1.17	.00	4.65
5th	55 00	1.20	1.77	5.44	8.41
5th	65 00	2.16	.48	1.84	4.48
5th	†66 00	1.50	1.60	78.23	81.33
5th	‡71 00	.00	.00	.00	.00
5th	72 00	3.60	1.05	.00	4.65
5th	73 00	.72	1.93	14.47	17.12
5th	74 60	2.40	1.20	.00	3.60
5th	81 00	2.22	1.20	1.84	5.26
5th	82 00	1.20	1.27	13.57	16.04
5th	83 00	3.60	2.35	.07	6.02
5th	91 00	.72	1.21	.00	1.93
5th	92 00	4.56	1.84	.00	6.40
5th	93 00	2.40	1.45	.00	3.85
5th	94 00	.84	3.00	.00	3.84
5th	95 00	2.64	2.36	2.79	7.79
5th	104 00	1.80	.47	.00	2.27
5th	105 00	.72	.33	.00	1.05
5th	141 00	2.16	1.08	.00	3.24
5th	151 00	3.24	1.00	.00	4.24
			\$65.07	\$40.51	\$142.80	\$248.38

* Car operated only 18 days; in shop for overhauling.

† Car overhauled.

‡ Car out of service for overhauling.

As to the use of the No. 2 velocipede motor cars, the road-master's districts on this system are quite long in many instances, especially on side and branch lines where the traffic is light. We furnished these men with a light inspection hand car and allowed them two laborers for crank hands, which cost \$30 per month each. In order to economize, we have begun furnishing No. 2 motor cars and cutting off one laborer, which

makes a saving in labor of \$360 per year. The fuel and repair cost of operating these cars does not average over \$3 per month per car; therefore, we have a net saving of \$324 per year per car, and at same time the roadmasters can get over their districts more frequently and to much better advantage.

EXPERIENCE OF THE NORFOLK & WESTERN.

We have 25 section motor cars in service, and all have given satisfactory service and are highly prized by foremen and men. In only one instance was a car reported as unsatisfactory and undesirable. In this case the car was transferred to another section and is giving excellent service, so the natural inference is that the fault in the first instance was with the foreman and not with the car.

The advantages of motor cars in section work are, the speed and ease with which forces are taken to and from work, saving time and increasing the efficiency of labor; the ability to respond quickly to an emergency call or to mass forces without delay for special work, and to employ competent and perhaps a better class of labor at points where without them the securing of laborers was a serious problem. At some points on our road no trouble is experienced in getting men to work on sections where a motor car is in use, where formerly for several months each summer not a laborer could be hired and it was necessary to import extra forces and domicile them at considerable expense. It is a common occurrence now for a foreman who is looking for laborers to be asked whether he has a motor car. If he has, it is easy to get men. We find still another advantage of section motor cars in their ability to carry section forces with tools up mountain grades of 1 to 3 per cent. at reasonable speed in all kinds of weather, whereas formerly it was frequently necessary for the men to walk and push their hand cars.

The light four-wheeled motor cars used by roadmasters, master carpenters and bridge foremen enable these officials to get over their territory quickly and see their men at more frequent intervals; and all concur in the opinion that the service has been much improved thereby. The use of these cars in the painting of track signs and signals is estimated to have reduced the cost of the work 50 per cent. The use of motor cars in the signal department is commented on as follows by our signal engineer:

"The service and efficiency of gasoline motor cars depend naturally upon the kind of men who use them; our supervisors and signal inspectors have reduced the cost of maintenance to a minimum. Their cars are seldom in the shops for repairs, but the average maintainer is careless in the manner of handling his car and allows it to run down to such an extent that cost of repairs, when made, is excessive.

"The speed attained by these cars is far in excess of what is needed for practical purposes, and there is no way of making a low maximum speed limit. We have had several cases where excessive speed (30 to 35 miles per hour) was the cause of serious accident to men in charge.

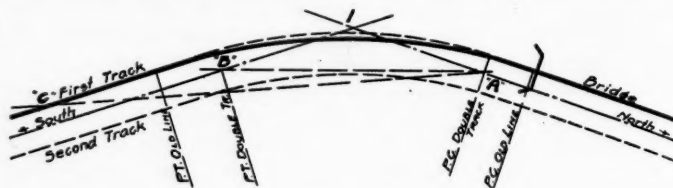
"There is no doubt of the advantage of having motor cars for maintenance purposes aside from the saving in labor. Many applications for positions have been received in which the question was asked as to the use of motor cars, and where they are used there have been few resignations of good men in comparison with the number of men employed."

At the beginning of 1911 the following railways were being actively constructed in Chile: Paloma to San Marcos, 26 miles; Choapa to Salamanca, 17 miles; Longitudinal Railway, whose construction up to November last was carried on by the government, was turned over for termination to the Howard Construction Company, whose bids were approved by the government; the lines from Rayado to Los Vilos, 80 miles; San Bernardo to Volcan, 47 miles; Mepilla to San Antonio, 33 miles; Alcones to Pichilemu; Curico to Hualane; Chillan to Las Termas; Osorno to Puerto Montt; Ancud to Castro; Saboya to Captain Fastene, and Pua to Curacautin.

A CURVE PROBLEM.

BY R. G. K.

A simple solution of a problem which a young engineer worked out several years ago when he forgot his field book may be of value to other engineers. His problem was to shorten up a curve on an embankment leading from a bridge so as to have the elevation run out before reaching the bridge. The old curve, about 1 deg. 30 min., started at the bridge. He assumed that a 2-deg. curve would fit and with an elevation of $1\frac{1}{2}$ in. and a runoff of about 75 ft., he fixed the P C about that distance from the bridge, turned an angle at A that would intersect the



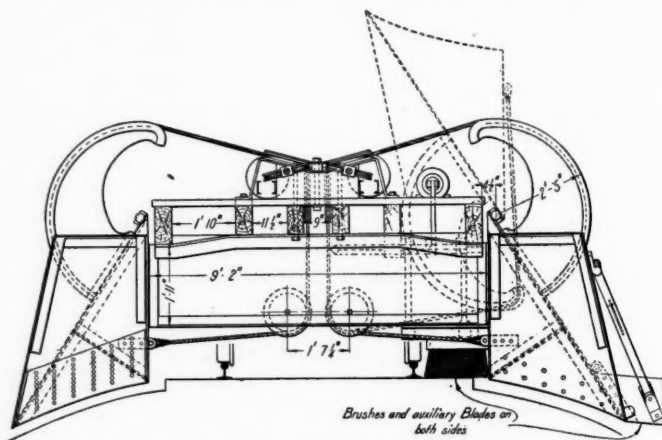
A Curve Problem.

old rail on the tangent beyond the curve at some point, C, and read the angle IAC . He then moved to C and measured the angle between the line AC and the tangent, added the angles IAC and ICA , and divided by 2. Returning to A he deflected this half angle, established the point B on the south tangent, thus making the angles at A and B equal to each other and to one-half I. For this reason, B became the P T of the curve whose degree was determined by dividing the sum of the angles IAC and $ICA = I$ by the length of the curve, which was found by measuring along the old track from a point opposite A to a point opposite B.

THE BURY BALLAST TRIMMER.

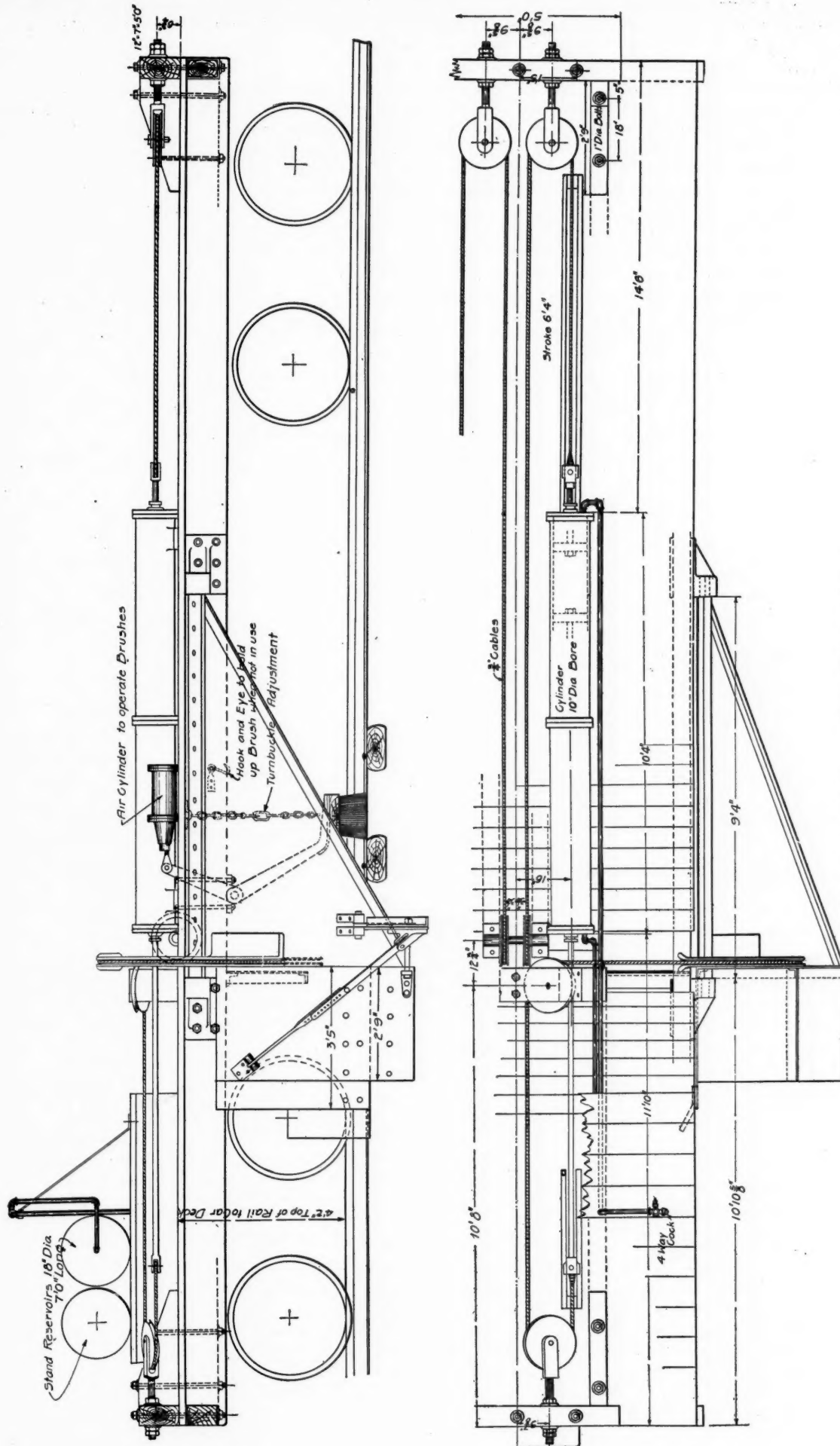
For a number of years the Canadian Pacific has been using a ballast trimmer which has been developed under the direction of its officers west of Winnipeg. Ordinarily the trimming up of the shoulders following the ballasting of track is done by manual labor at heavy expense, a smaller gang following the main ballasting gang and shaping up the shoulders by hand with shovels. Excess gravel is run back and forth on rubble cars to fill out the weak places.

The Bury ballast trimmer is a mechanical device to do this



End Elevation of Ballast Trimmer.

same work with but little labor. It consists essentially of a car with projecting wings which spread down the ballast to the desired slope. Steel brushes extend from the outer base of the rail out about 21 in. on a level with the top of the tie, and beyond this a heavy steel wing extends down over the shoulder to the sub-grade, the shape of the lower edge of the wing conforming to the standard section of the roadbed, which on the

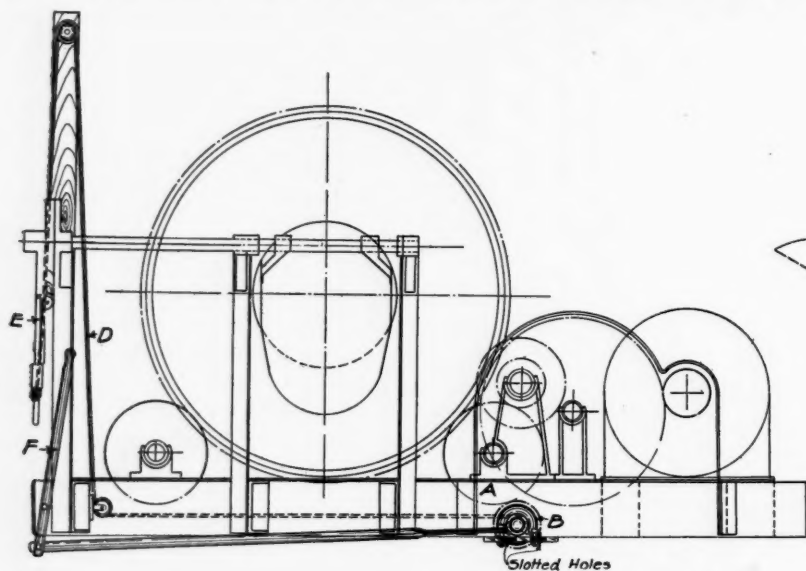


Elevation and Plan of Bury Ballast Trimmer.

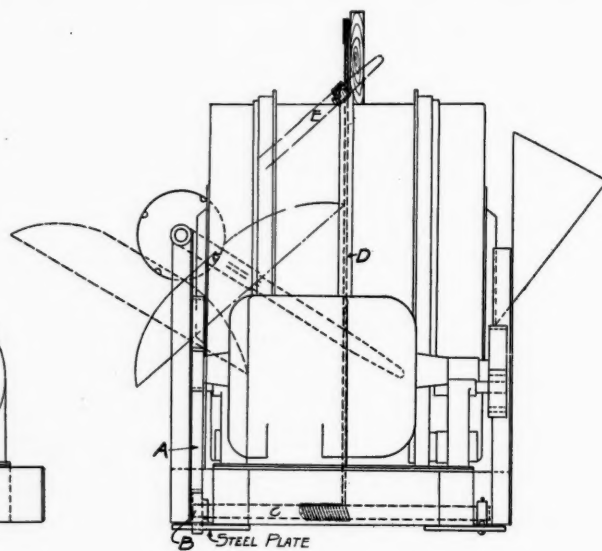
Canadian Pacific is a smooth curve. An auxiliary blade can be attached to the wings if it is desired to shape the bank beyond the main wings. The movement of the brushes and wings is operated by air, one cylinder running both brushes, while a separate cylinder is provided for each wing. When not in use the brushes can be hung up out of the way by hooks and eyes provided for that purpose, while the wings are revolved vertically over the car. In operating this ballast trimmer sufficient ballast is unloaded to raise the track the required amount, and this is put under. Then enough more ballast is unloaded to build out the shoulder and the ballast trimmer is run over the track, shaping the bank. The operation of the car requires but one man to handle the air in raising and lowering the wings. It has been found advisable, however, in most cases to have two additional men watch the wings to prevent any damage from wedging of larger stone or other material and to inform the operator concerning the location of crossings, bridges or other interference in order that he may raise the wings accordingly. The car is pushed by a road locomotive in charge of a regular train crew. As much as 135 miles of track has been covered in two days with such a car, but it is not, as a rule, advisable to allow the track to remain unshouldered for such a length of time. It has usually been found advisable to trim up the track

DUMPING A CONCRETE MIXER.

A negro laborer who was put in charge of a concrete mixer on a big bridge job saved himself considerable labor by developing a device for dumping the mixer. A No. 40 Ransome mixer was in use, and when running full it was very difficult for one man to raise the dumping lever with its load of concrete. The arrangement for dumping as worked out in this case is shown in the accompanying figure. It was made on the ground without the use of skilled labor and with slight modifications should be applicable to many mixer installations. The dumping lever, *E*, is raised by a rope, *D*, which runs from the lever over pulleys to a shaft, *C*, which carries at one end a wheel, *B*, that can be brought into contact with the wheel, *A*, supporting the mixer drum. The end of the shaft nearest this wheel is carried in a bearing which can be moved back and forth on a steel plate attached to the supporting frame under the mixer. The movement necessary to bring this wheel in contact with the moving wheel is obtained by a rod attached to the bearing, which is carried under the supporting platform of the mixer to a vertical lever, *F*, which is pivoted by the floor near the point where the operator usually stands. By throwing this lever the small wheel, *B*, on the auxiliary shaft *C*, is brought into contact with the



Device for Dumping Mixer.



whenever 8 or 10 miles of bank is ready. The car works to best advantage, of course, when the ballast is dry. As gravel ballast is used almost exclusively on the Canadian Pacific lines, experience with the car has been entirely with this class of ballast. Even with much interference from trains, this car has proven very economical, as it is possible to cover long distances with a very small amount of labor as compared with the older methods.

The railway construction in Brazil during the year 1910 represents the most notable progress of the past decade, and points to a rapid development of the interior districts by placing them in better communication with consuming markets, as well as by opening them to the outside world as markets for foreign goods. The total mileage added to the railways already in traffic exceeds the gain in any previous year, and is characterized by a greater distribution throughout the country and by a marked tendency to unify the several systems in the republic. The railways, extensions, and branches opened to traffic during 1910 amounted to 1,189 miles. Judging from the large number of lines and extensions which are now under construction in this country and from the mileage which has been opened to traffic since the first of the year it may be reasonably expected that 1911 will not fall far short of 1910 in this respect.

moving wheel, *A*, the shaft is rotated, winding up the rope, *D*, which runs to the dumping lever, *E*. This device has been in operation for some time and has done its work satisfactorily. The labor required to throw the small operating lever is negligible.

FOREIGN RAILWAY NOTES.

The total length of the main line of the Goyaz Railway, Brazil, and its branches is 850 miles. The surveys for both trunk and branches are now completed. It is said that about 1,500 men are now employed on the different sections. Rails have been laid for a distance of 85 miles from Formiga, and the roadbed is now completed for a distance of 88 miles.

The government of Chile has extended the tariffs of the Chilean Transandine Railway, now in force, until November 18 of the present year, with the exception of the tariff on stock to which an additional charge of 50 per cent. will be added. The railway is required to submit to the government a lower tariff than that now operative, provided it can obtain a proportional reduction from the Argentine Transandine Railway. The tariff now in use dates from November 18, 1907, and the rates can not be reduced without the approval of the Chilean government.

PROTECTION OF TEMPORARY BRIDGES AGAINST FIRE.*

Bridges catch fire from four different sources:

1. From sparks or live coals from ash pans of locomotives.
2. From fire in grass on right-of-way creeping up under bridge and setting it afire, which grass was first set on fire by sparks from stacks of locomotives, by section men letting fire get away from them, or by passengers throwing cigar stubs out of car windows.
3. From nearby forest fires.
4. From fusees.

It is found that about 85 per cent. of such fires are caught in the deck, caused by cinders or coals dropping from ash pans; 10 or 12 per cent. are caused by grass on the right-of-way burning, or grass under the bridge catching fire, and a very small per cent. caused by forest fires or fusees. There have been three or four known cases of fusees doing damage to bridges. Bridges burned by forest fires do not materially endanger the lives of employees nor the traveling public because there is always warning given before any bridge can burn from this cause. Since the burning of bridges by fusees and forest fires is so small they are left out of this discussion, and the protection of bridges from cinders from ash pans, and from the burning of grass below only are considered.

Considering the latter case first, it is recommended that the grass be sheared off around each pile bent or spaded up to kill the vegetation for a distance of two feet on each side of the piles and this space covered with cinders, slag, gravel, or stone dust, which will not support vegetation, and that all brush be kept cleared away in the immediate neighborhood of the bridge. Grass and weeds should be burned under the supervision of the section men at suitable times according to the present practice on other parts of the right-of-way. As an extra precaution, which would not cost much, a row of cinders, slag, gravel or stone dust, which will not support vegetation, can be placed parallel to the bridge on each side of same and about ten feet distant from the bridge, which would tend to prevent grass fires on the right-of-way from creeping up to the bridge; this row or ridge to be about one foot deep and about two feet wide. It would probably have to be replaced once in every four or five years to keep it effective.

The protection of the decks of bridges from sparks falling from ash pans has been taken up by many railways, and different methods have been used with fairly good success and at reasonable cost. Some roads have used a ballasted deck with treated timbers, others have filled in between the ties with strips and then covered ties and strips with two or three inches of gravel, and others have planked over the decks of bridges with two-inch planks and then covered the same with gravel.

In considering a ballasted deck or floor system it is figured that the piles are cedar and the guard rails, planking, stringers, and caps are treated with a preservative. Cedar piles were taken as a basis as their life is about twenty years and they are good for two decks of standard bridge. Also since treated tamarack or Norway pine will cost about the same as cedar and the life when treated is about the same as cedar untreated. The first cost of this type of bridge will exceed the first cost of standard pile bridge by \$2.56 per foot. The cost of this ballasted deck bridge with treated timbers will be \$12.56 for twenty years' life, not considering the running repairs. The cost of a standard pile bridge for twenty years' life would be \$15.47, not considering the running repairs. The objection raised to the ballasted type of bridge by many is that the initial cost is too great, that it approaches too nearly a permanent bridge and that it is difficult of inspection. If an opening is to be maintained for twenty years by a temporary bridge, this kind of bridge will not cost as much as a standard pile bridge. It is cheaper

in regard to running repairs as the lining and surfacing will be done by the track forces, while the inspection can be done from underneath the bridge.

It would not, however, be advisable to put ballasted decks on old or existing pile bridges as the piles would either have to be cut down about nine inches, or the grade on either side of the bridge raised this amount, either of which would be very expensive.

The other methods of protecting decks of temporary bridges are similar in that they have a filler between the ties and then a coating of two or three inches of gravel over the deck, except one which has a sheet iron covering over the deck.

The objection to this kind of protection is that when gravel is placed on untreated timber it will tend to decrease the life of the timber two or three years. Such bridges are also expensive to maintain as many of them have to be lined and surfaced during the winter and spring months, because of the heaving on either side. To line and surface such bridges it is necessary to take off most of this top dressing and then replace it, and most of this work has to be done in the winter months when it is frozen. The additional cost of such bridges runs from twenty-six cents per foot to eighty-three cents per foot, which difference is caused mostly by the varying amount of material necessary for fillers between the ties.

The deck covered with sheet iron has the advantage over the ballast covered deck that it does not tend to decrease the life of the bridges but to increase it. This cover, however, is in the way in maintaining the bridge as it has to be removed when necessary to make any repairs. Such a cover can, however, be removed and replaced much more cheaply than the ballast coating. This kind of protection for a bridge is objectionable where there is any current for electric signals carried in the rails. Also, in tearing it up and replacing it many times, it becomes filled with holes and parts are liable to get loose.

Therefore, if a deck protection against fires is to be given temporary bridges, it is recommended that for old pile bridges and bridges now in place the cheapest method be used, costing twenty-six and twenty-seven cents per foot; and in the rebuilding or building new, a ballasted deck bridge with treated timbers be used.

There is another plan which many do not favor, but which it is thought would be quite effective and cheap; that is, to paint the top of the deck—guard rails, ties, stringers, and caps, with the best fire-proof paint to be had and then sprinkle the same with sand. The paint should be put on heavily enough to hold considerable sand. The timbers should be seasoned two or three months before the paint is applied. The Peninsula division has tried this method to some extent in years back using standard No. 12 extra heavy paint, and it seems to have been quite effective.

During the past four years there has been a loss of about \$16,000 from bridges burned, or about \$4,000 a year, for the lines East and West. During this time there were no injuries nor lives lost, but there were a few narrow escapes. It develops also from comparison that the greatest loss from fire was on the lines that had the smallest traffic, for where the traffic was heavy there were a great many fires discovered and put out before much damage was done.

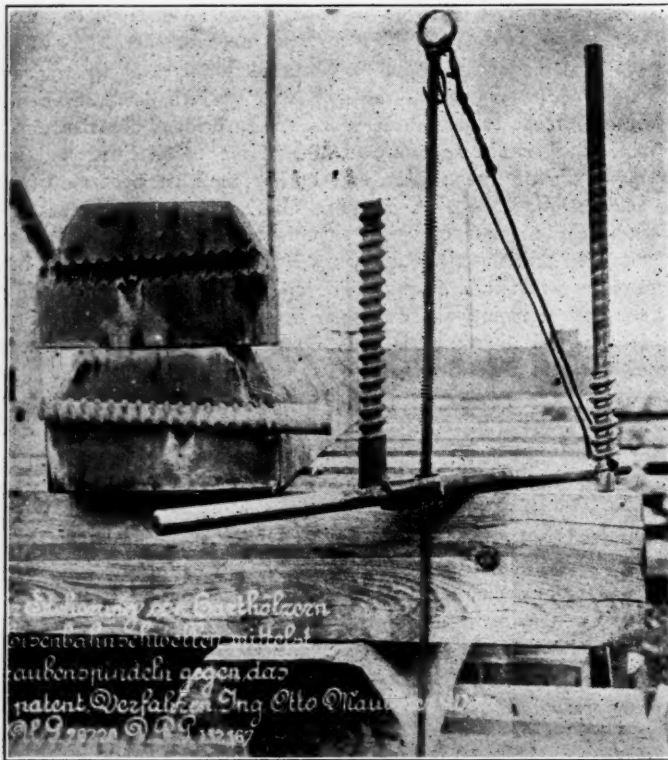
Considering the comparatively small damage to bridges by fire as compared with losses this company pays out each year for damage done adjacent property, it seems that before much money be spent on protecting bridges that it would be advisable to see if something could not be done in the line of making an ash pan and stack for locomotives so that these fires could not be started, or something be done to remove the cause of the fires. These conditions are improving constantly in regard to ash pans and netting arrangements for stacks. An arrangement now being made for the application of water sprinklers to ash pans to deaden the fire in them.

* From a report presented at the April meeting of the Operating Officers' Association of the Northwestern Lines.

DEVICES FOR PREVENTING THE SPLITTING OF TIES.

BY HERMANN VON SCHRENK.

Many kinds of timber used for tie purposes check and split badly, after creosoting, during the seasoning process. This is particularly true of such timbers as beech, red oak, birch and chestnut. Some years ago the writer suggested the use of S-irons, i. e., curved pieces of beveled steel, which have been used on various European railways for many years. A number of roads in the United States have been using these irons for



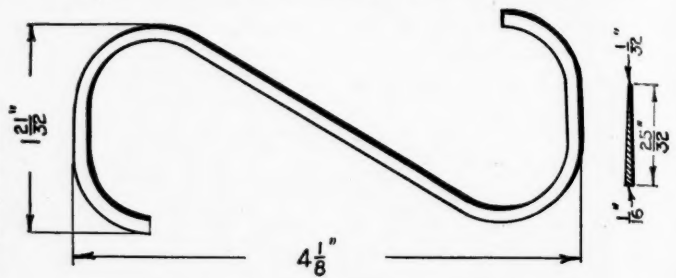
Section of Tie and Dowel.

several years, and they have to a certain extent proved very beneficial. One road puts these irons into the end of every red oak tie and into many gum ties as soon as the ties are received in the seasoning yard. Plans are now being made to drive these irons on the right of way as soon as the ties have been inspected and accepted by the railway company.

During December the writer had occasion to study the methods for preventing splitting used in Europe. In Germany the S-iron is still universally applied, although the standard shape has been changed somewhat, the present form being shown in the drawing. Two sizes are used, one $4\frac{1}{8}$ in. long (7.87 in. of straight bar), the other $5\frac{3}{8}$ in. long (9.85 in. of straight bar). The smaller irons are made of steel 0.785 in. wide, 0.08 in. thick at the thick edge and 0.04 in. thick at the thin edge, while the larger ones are 1.18 in. wide, 0.12 in. thick at the thick edge and 0.04 in. thick at the thin edge. The smaller size weighs 0.013 lbs., or 100 irons weigh 10.34 lbs., the larger, 0.26 lbs., or 100 irons weigh 25.96 lbs. For badly split ties bolts are used.

A good many of the hardwood ties, particularly the beech, on the Austrian state railways and the Hungarian state railways split very badly in drying. These railways have used the S-irons of the type used in Germany with good success. Recently a new method for preventing the splitting of ties has been adopted on a considerable scale both on the Austrian and the Hungarian state railways. It is called the Mautner dowel method, and is not patented in the United States. Up to the present time approximately 300,000 beech ties which cost about 70 cts. each have been furnished with these dowels. The dowels are

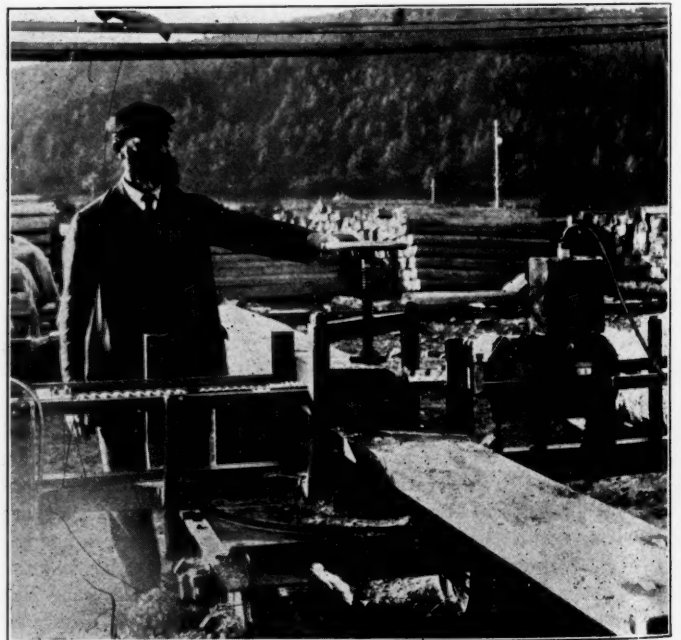
made of beech wood and have the form of the Collet dowel, used so extensively on various European roads for increasing the holding power of screw spikes. The Mautner dowels are about 12 in. long and about 1 in. in diameter. At both the Austrian and the Hungarian treating plants all new beech ties are provided with two dowels. Special emphasis was put by the engineers in charge on the fact that it is very desirable to



S-Iron for Preventing Splitting.

insert the dowel into the ties while they are still as green as possible in order to get its maximum value. At all plants visited, the dowels are still put in by hand, although preparations are being made to apply them by means of machinery. At the present time a number of ties are laid on a table, and two holes are bored through them from side to side at a distance of 4 in. to 6 in. from each end. A threading tool is then run through the hole first made, cutting the thread for the dowels, after which the dowels are inserted and any projecting parts sawed off.

From the Austrian state railways the following figures were obtained as to the cost of the dowels, labor, etc.: Two dowels per tie cost 1.50 cts. each, labor for boring holes for inserting the dowels, 1.72 cts. to 2.58 cts. per tie. As an actual matter of fact, the state railways pay the contractor who furnishes the



Manner of Inserting Dowels.

ties with dowels 6.88 cts. per tie for furnishing each beech tie with two dowels.

At the treating plants of the Hungarian railways, which are owned and operated by the state, the cost of providing one beech tie with two dowels is 5 cts. per tie. At one of the plants on the Hungarian state railways, the dowels are furnished in the shape of round cylinders, and the screws themselves are cut by hand with a small apparatus. 1,000 round dowels, without the screw, cost \$5.60.

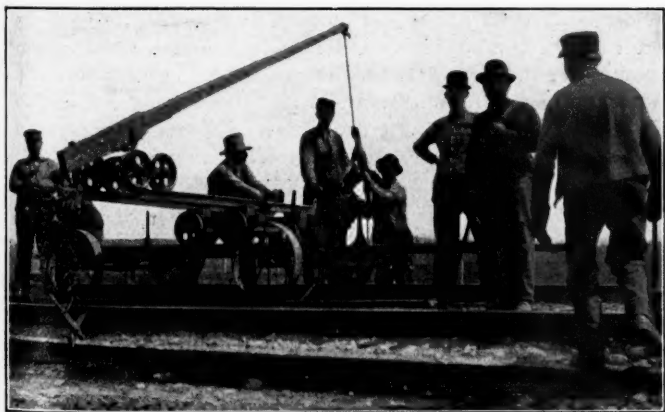
Mr. Mautner, the inventor, is at present at work on a machine, by which he claims that he will be able to reduce the cost of operation very materially. At the present time he states that the hand machine for boring holes, the shaper and the machine for screwing in the dowels can be purchased for \$24. He estimates the cost of a machine approximately as follows:

Railway carriage and planks.....	\$120
Boring machine	125
Thread-cutting machine	250
Boring tools	25
Tools for screwing in dowels.....	125
	\$645

A large number of ties were examined which had been provided with these dowels for six months or more. The ties so provided certainly showed a very marked decrease in checking when compared with those which had no dowels. The accompanying photograph shows a tie cut through, and one of the dowels, also a general view of the yard at one of the plants of the Guido Rütgers company, contractors for the Austrian state railways, showing the manner in which the dowels are being inserted. The railway engineers who had used these dowels are without exception favorably impressed, and stated that they mean to continue to use them in increasing quantities.

RAIL RE-LAYING CAR.

A device tending to reduce the amount of manual labor connected with re-laying rails is being used on several roads this year. The following notes were taken while watching one in service on the Burlington at Waterman, Ill., on May 5: As shown in the photographs, the device consists of a lever pivoted on a small truck which moves at right angles to the roadbed on a small track extending out over the shoulder. This small track, in turn, rests on another heavier truck, which rests on a track parallel to the roadbed and is supported on the main frame of the car. In this way there can be motion either parallel to or at right angles to the track without moving the body of the car. The main car is supported by two double-flanged wheels running on one rail and two flangeless wheels running on a plank laid 4 in. inside the spikes on the opposite side. A pair of tongs on the lever side of the car are clamped to the running rail to maintain the stability of the car when another rail is

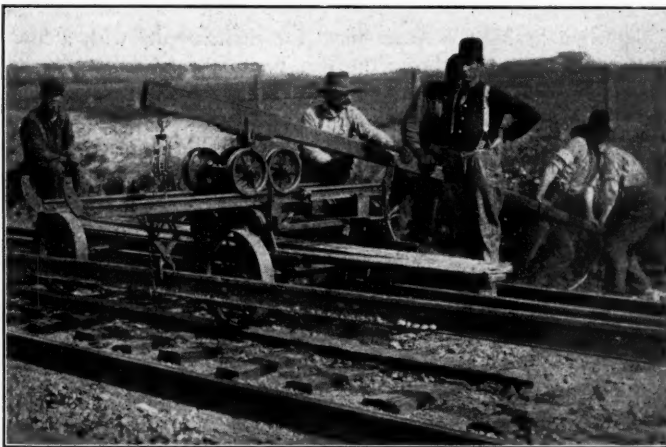


Picking Up Rail.

being raised. The hoisting lever can be moved back and forth within certain limits to adjust the leverage to the weight of rail handled. Hand car wheels with short axles are provided which can be attached to the car, lifting the flangeless wheels above the ties when it is desired to move it from point to point. The car can be readily removed from the track in four pieces, although time is not essential here as a car is naturally always working under protection of a flag.

In re-laying rail the spikes are pulled, rail thrown out, and the ties plugged and adzed as usual, the machine simply replacing the tongsmen in handling the new rail. In operating the car the upper carriage is run out over the shoulder, the lever

raised, and the clamp placed on the head of the rail at the center as shown in the illustration. As the lever is pulled down, the rail is balanced by one man at each end. The upper truck is pulled in until it strikes a lug fastened on the rail when the rail is directly over its location on the ties as shown in the photograph. The body is then shifted backward or forward on the second truck until the rail is properly heeled in at the joint, when it is lowered onto the ties and the car pushed forward to the next rail, the smooth wheels running on planks laid on the ties. It is evident that careful unloading of the rail is of much importance here, the same as with ordinary methods, for if each rail has to be carried several feet, it seriously affects the speed.



Ready to Place Rail.

In operating the car at Waterman nine men were employed as compared with 14 men necessary to handle the 90 lb. rail with tongs. It required four men on the lever, one to place the clamp on the rail, two at the ends of the rail and two picking up and placing the plank. The gang of 50 hoboos was distributed as follows: Thirteen men drawing spikes and throwing out the old rail; twelve plugging and adzing the ties; nine on the car; one distributing spikes and bolts behind the car; twelve placing the rail to gage, bolting and spiking; two flagmen and a waterboy, in addition to the timekeeper, foreman and assistant foreman. The speed is about the same using the machine as in using tongs. This gang has averaged a half mile of finished track per day since the work was started about a month ago, and on the day the accompanying photographs were taken 8,300 lineal feet of rail was laid in 8½ hours, the joints being half bolted and ties three-fourths spiked, besides closing up for seven trains. Of this amount 5,379 lineal feet were laid in the afternoon in 3 hours and 15 minutes actual time at work with no interruptions. With the large number of trains on this line in the mornings it has been found advisable to lay rail in the afternoons and to do the back work of uncoupling the old rail and completing the bolting and spiking in the forenoons. Also in using the car it has been found advisable to have the timekeeper mark the centers of the rails in advance of the gang in order that no time will be lost in balancing the rail.

In addition to the saving of 5 men while re-laying rail, the car is of special advantage when the rail has to be lifted over ballast freshly plowed off or carried up a shoulder where the footing is insecure. The men naturally like it and it should prove a factor in holding them and also obviate the necessity for paying a higher rate for steel gangs than for other gangs. The first car of this type was built over a year ago by Edward Laas, then engineer maintenance of way of the C. M. & St. P., and John Reinehr, superintendent of the rail mill at Savanna; it is now manufactured by the Q. & C. Company, New York and Chicago. We are indebted to W. S. Kirby, superintendent, and R. C. Violett, roadmaster, of the Burlington, for assistance in securing this information.

DIFFERENT METHODS AND COMPARATIVE COSTS OF DITCHING CUTS.*

BY GEORGE H. BREMNER,

Engineer, Illinois District, Chicago, Burlington & Quincy.

The usual methods of ditching cuts are: First, by hand with a shovel; second, by loading on rubble cars and unloading by hand; third, by the use of a train of flat cars, loading by hand and unloading either by hand or with a plow; fourth, by the use of cars, loading by means of a mechanical ditcher and unloading by hand or with a plow; fifth, by a ditcher which pushes the dirt out at the end of the cut. Each of these methods is useful and has its proper place in the economical handling of work.

Shoveling by hand is economical for shallow cuts with a low bank where men can throw the dirt up to the top of the cuts, leaving a ridge which prevents water from outside the cut running down over the face. It should not be used where the top of the cut is so high that the dirt cannot be shoveled up to the top of the original ground or disposed of by widening the bed for the track. Dirt should never be placed against the face of the cut where it will be washed back into the ditch at the first rain. In good weather a gang of six men should handle about 12 yards per man per day, which would make the cost about 16 cents a yard if we figure the men's time, including the foreman, as worth \$2 a day.

Loading dirt on a rubber car and taking it out by hand should be used on branches where there is a very light travel—where the work will not be interfered with by trains and where the amount of ditching is comparatively small. It costs more than the first method, where there is not a large amount of earth to be removed. This should cost, with a gang of six men and a foreman, from 24 to 32 cents a yard, as a man will load and unload six to eight yards a day. If a flagman is necessary, an additional cost of 7 to 9 cents a yard should be added.

The use of a work train is advisable where the material is easily shoveled by hand, where machinery is not available, and where cuts are large and the amount to be removed is small. It is not a good plan for wet cuts and in most cases will cost more per yard of earth moved than any other method. It may, however, be the most economical because the ditch can be shaped up better with the removal of less material than by mechanical means.

The dirt can be unloaded where it will be useful in widening banks or preparing the roadbed for ballast, either by hand or by plow and cable. Where there is but a small amount of dirt loaded each day the best method is probably by hand, as it can be placed just where it is wanted, and the men cannot be used to advantage while the cars are away from the cut. However, with a large output the plow is much cheaper than hand work in unloading. It can be pulled over the flat cars either by cable attached to the engine which handles the train or by the use of an unloader, which requires that the road engine be equipped to attach to and furnish steam to the engine which handles the unloader. With a large output it is most economical to have a plow and Lidgerwood attachment for the cable. I would estimate cost of doing work-train work as follows:

Foreman	\$2.00
25 men, at \$1.60	40.00
Engine crew and watchman	9.50
Train crew	6.90
Coal and engine supplies	10.00
Total	\$68.40

Under light traffic and good weather this outfit should handle and unload by hand about 250 cu. yds. a day, at a cost of 27 cents a yard. By the use of a cable and plow for unloading, the output should be increased to 325 cu. yds. a day, or 21 cents a cubic yard. With a Lidgerwood to handle the cable, there would be

an additional cost for the Lidgerwood engine and supplies for the engine, amounting to about \$4 a day, making the total cost \$72.40. With this the output should be increased to 360 yards a day, or 20 cents a yard. These figures are based on good weather and dry cuts.

There are a number of different machines used for loading the material out of ditches on cars. The steam shovel is only desirable when a very large ditch is needed or a very large amount of material is to be taken out. With the steam shovel the whole train may be either dump cars, cars with sides of the Haskell & Barker type or ordinary flat cars. With the regular ditchers, only flat cars can be used to advantage.

The types of ditches with which we are most familiar are the Marion and Barnhardt, which, in general, may be described as small steam shovels, made so that the arm swings at right angles to the track with a small dipper to take the dirt out of the ditch and load it on the flat cars behind the shovel, which is pulled ahead over the flat cars as fast as they are loaded. The American Railroad Ditcher consists also of a steam shovel with a longer arm, which has a somewhat farther reach from the track. The dipper is larger, although, of course, that can be varied to suit the size of the machine; it is a somewhat heavier machine and is self-propelling over the car. It will take out a wider ditch and can also be used for a variety of other purposes similar to the use of a locomotive crane. I would consider this ditcher as very good for taking out heavy material, such as shale or bluff debris.

The Mahoney ditcher works on a different principle from the other two named. Like both of them, it will load on the cars behind it as it is moved ahead, but there must be a Lidgerwood to properly handle it.

By the use of mechanical loaders, and unloading by plow with Lidgerwood, work can be done for about 15 to 25 cents a yard. The costs should be

Operating the ditcher	\$19.10 per day
Train crew	17.05 per day
Material and coal	20.00 per day
Total	\$56.15 per day

Three hundred yards a day would make the average cost about 18½ cents, the amount of work done in any of these connections depending more or less on the amount of traffic.

Pushing dirt out of the end of a cut instead of loading it up and carrying it away can be used to advantage in hilly and mountainous districts, or where the material gets very wet and soft and cannot be handled on a flat car to advantage. For this service the Mahoney ditcher, which is equipped to drag the plow alongside of the track by means of running the locomotive ahead, does efficient work.

The prices estimated above are average prices. The different machines on the market advertise the cost per yard handled by them to run anywhere from 6 cents up, and that the ditchers will handle sometimes a thousand yards or more a day. I do not think we have ever equaled this with any of our machines, and it would require unusually good conditions of material and traffic to allow an output of this size. Let me emphasize that the main advantage of machine work over the ordinary hand work is that wet cuts can be handled by machinery which possibly could not be handled at all by hand, and that work is not so dependent on good weather.

The government of Chile has granted a concession for the construction of a steam railway from the station of Curacautin, or Poncoche, on the line of the state railways, to the boundary of the Argentine republic. The proposed railway will have an approximate length of 75 miles, and construction is to commence within a period of six months from the date of the approval of the plans by the federal government. The plans are to be submitted within a term of two years and the construction terminated within four years.

* Read before the annual meeting of the Burlington Association of Operating Officers.

WATER TANKS EXCAVATED FROM THE SOLID ROCK.

The San Pedro, Los Angeles & Salt Lake has taken advantage of the natural topography of the country in the construction of two water tanks or cisterns with quite unusual features. They are excavated from solid rock. At one point a cistern was excavated in a massive and very solid conglomerate which overlies a flat bench about 40 ft. above the track level. The inner surface of the cistern was coated with rich concrete to prevent possible leakage through seams in the formation, and a roof was built over it. Near the track the bench of rock slopes very steeply toward the track. A small drift was driven through this slope to the bottom of the cistern, and a pipe to supply a standpipe alongside the track immediately opposite was laid in this drift and concreted in place. Water is pumped into the cistern from a well alongside the track below. It was found that this tank, having a capacity of 150,000 gals., could be built for the same cost as a standard steel water tank of half the capacity and its life is of course much greater.

At another point, an emergency storage cistern holding 300,000 gals. was built in the hills about two miles back from the track. It was excavated in dolomite rock, cemented, roofed, and fitted with automatic control. The water supply is drawn from springs about 12 miles away, and the capacity for storage is great enough to furnish several days' supply of water in case the pipe line is put out of commission temporarily by cloudbursts.

These cisterns and their connections were built from original designs prepared under the direction of E. G. Tilton, chief engineer.

A SIMPLE RAIL TONG.

The accompanying photograph shows a very simple rail tong used on the Aurora division of the Burlington. It consists of a wrought iron bar with four hooks as shown, the distance between

**Single-Handle Rail Tong.**

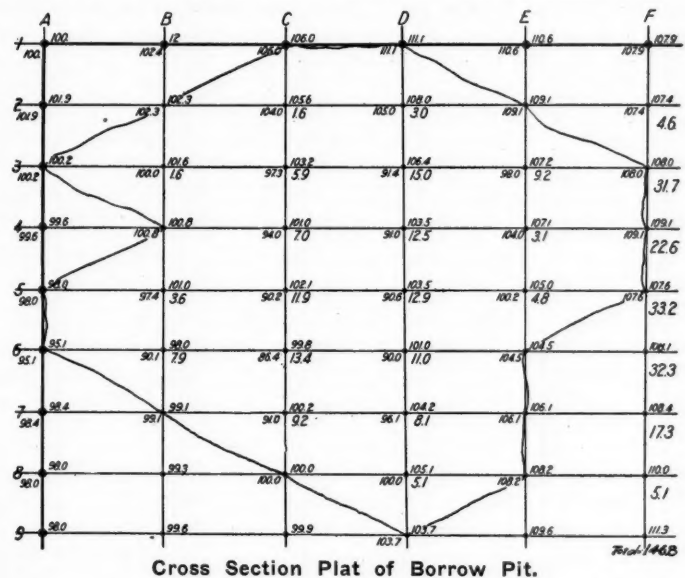
the ends of the hooks being just sufficient to pass it over the head of the rail. It is much more convenient than the long two-man tong for turning the rail over, and is especially advantageous when used for heeling rail in at the joints, in connection with

the rail re-laying machine described in another column. These tongs were made at the shops at Aurora under the direction of W. S. Kirby, superintendent, and R. C. Violet, roadmaster.

METHOD FOR CROSS-SECTIONING BORROW PITS.

In general the method used for measuring excavation quantities over irregular areas, such as large borrow or gravel pits, is to take cross sections at the even station or 100-ft. intervals with as many pluses or intermediate readings as the nature of the surface demands. When large areas are involved this causes very laborious work. After the notes are taken in the field they must all be platted and then figured. As a rule when the areas are large the intermediate readings are very frequent, and with long cross sections each additional section means much additional labor.

A simple but quick method for measuring such borrow pits with a very large saving of labor is here given. In laying out the work two base lines are run at right angles to each other.



On one line stations are marked at intervals of 10 ft. and numbered consecutively. On the other, stations are marked alphabetically at intervals of 27 ft. After laying out these base lines elevations are taken on the lines A, B, C, etc., at intervals or multiples of 10 ft., depending upon the nature of the ground, care being taken to note and take readings at the 10-ft. point nearest to changes in slope. Where slopes are uniform it is not necessary to take readings oftener than once in perhaps 100 ft., as the intermediate readings can be interpolated later in the office. The various readings will be marked in the notes B₃, D₆, etc. The field notes for the monthly estimates are taken in the same way.

In the office these base and auxiliary lines are platted to some convenient scale on tracing cloth and the original elevations obtained from the field notes or by interpolation are placed just above the intersections. Blueprints of these are made, and as the field notes for each monthly estimate come in the new elevations at all intersections are written just below the original elevations. The difference between these figures gives the amount the surface has been lowered, and the sum of these differences with the decimal point moved one place to the right gives the total number of yards of material removed, no multiplication or division being necessary. The blueprint can then be filed for future reference.

This method is theoretically correct, and in nearly all cases by proper arrangement of the base lines is sufficiently accurate in the field without further intermediate readings. Compared with older methods the field work in taking the original notes is perhaps as slow, but the time required for taking later estimates is much less, and that required in the office is very much less.

General News Section.

The Illinois anti-pass bill has been killed by the house committee on railways.

One hundred and twenty conductors of the Southern Pacific, from points in and near San Francisco, are visiting New York and other eastern cities as the guests of their employer.

The Western Pacific has increased the pay of conductors, enginemen, firemen and brakemen, substantially granting their request for rates equal to those paid by the Southern Pacific.

Commencing May 15 the Kansas City Southern will run daily for about three weeks a special fast freight train from Siloam Springs, Ark., to Kansas City, Mo., to carry the heavy strawberry shipments from southern Missouri and northern Arkansas.

The strike of the maintenance of way employees in the Chicago terminals that was called by the International Brotherhood of Maintenance of Way Employees has been declared off on the Illinois Central, the Baltimore & Ohio Chicago Terminal, and the Chicago & Western Indiana.

The United States Express Company has begun suit in the Supreme court of New Jersey, against the mayor and police department of Jersey City to recover \$250,000 on account of losses sustained during the strike of wagon drivers last autumn. The express company charges that the city failed to furnish proper protection to the company and did not take adequate means to suppress rioting.

The secretary of the Brotherhood of Railway Trainmen, at Bakersfield, Cal., has filed a complaint with District Attorney Goodcell charging the Atchison, Topeka & Santa Fe with violation of the full crew law by badging a Wells-Fargo express messenger as a brakeman on a run between Barstow and Randsburg. The complaint has been forwarded to the state railway commission, which will hold a hearing.

At Rheims, France, on Monday last, Henry Weyman, said to be an American, carrying one passenger, flew in a monoplane, a distance of 17 miles in 10 minutes, 30 seconds. Lieutenant Fequent followed this in a new monoplane and made the distance in 10 seconds better time, or at the rate of 100.7 miles an hour. The first flight was made in a strong wind, in which the machine plunged violently, its height constantly varying from 30 to 300 ft.

The Western Classification Committee will hold its regular semi-annual meeting at Milwaukee, Wis., beginning July 18. Pending decisions of the Interstate Commerce Commission in the recent rate advance cases, no meeting was held in January of this year nor in July, 1910, and an unusual amount of work will, therefore, be taken up. At a preliminary meeting on July 11, shippers will present arguments for and against certain proposed changes in classifications and ratings.

An inspection of the almost completed passenger station of the Chicago & North Western at Chicago was made on May 15 by a large company of the prominent officers and directors of the road, the party including Marvin Hughitt, chairman of the board; W. A. Gardner, president; and W. K. Vanderbilt, Jr., Homer Miller, Chauncey Keep and David P. Kimball, directors. After going through the station they started for the west on an inspection trip, leaving on a special train which was the first passenger train to go out of the new station.

The Western Union Telegraph Company has notified its operators that the company intends before long to furnish typewriting machines where needed. At present, and ever since typewriters have been used in telegraph offices, the operators have had to furnish the machines at their own expense. The general manager of the Western Union has also issued a notice informing employees that they may feel free to send grievances direct to the general manager whenever satisfaction cannot be had from the immediate superior officer after the presentation of a complaint in writing.

Recent improvements made by the Chicago Great Western and the Burlington in passenger train service between Chicago and

St. Paul and Minneapolis include, among other features, special accommodation for women in the way of private drawing room and library compartments; the Chicago & North Western on its "North Western Limited," which runs between the same points, now has a composite observation library and buffet-smoking car. The C. G. W. has also adopted the plan of allowing passengers to reserve dining car seats at the time transportation tickets are bought and to order the evening meal as early as 10 a. m.

The New York State Public Service Commission, Second district, reports that during the month of March the number of passenger trains run in the state was 63,512; and 88 per cent. of these arrived at division terminals on time. In the list of causes it appears that over 47 per cent. of the delays were caused by waiting for other trains; so that in reality only about 7 per cent. of the trains lost time, instead of 12 per cent., as appears from the statistics. Of the large roads of the state, five reported 90 or 91 per cent. on time, namely, the Delaware & Hudson; Delaware, Lackawanna & Western; Erie; Lehigh Valley, and the Long Island. The New York, New Haven & Hartford, all of whose main line passenger trains in New York state are run by electric locomotives, reported 95 per cent. on time.

The legislature of Massachusetts has passed and the governor has approved a law making it a crime punishable by fine or imprisonment, to publish any false statement regarding the merits of the stock or the financial condition of any corporation, partnership or individual. The law provides that: "Any person who with intent to defraud makes or publishes, or causes to be made or published in any way whatever, or permits to be so made or published, any book, prospectus, notice, report, statement, exhibit, advertisement or other publication of or concerning the affairs, financial condition or property of any corporation, joint stock association, partnership or individual, which . . . shall contain any statement which is false or wilfully exaggerated, and which shall have a tendency to give a less or greater apparent value to the shares, bonds, property or assets of said corporation, . . . than said share . . . in fact possess, shall be punished by a fine of not more than \$5,000, or by imprisonment for not more than 10 years, or by both such fine and imprisonment."

Opening of Tacoma Union Passenger Station.

As previously noted in the *Railway Age Gazette*, the new Union station which has been built at Tacoma, Wash., by the Northern Pacific was formally opened on May 1. The opening attracted a crowd of about 30,000 people; and among those who delivered addresses were the governor of Washington, the mayor of Tacoma, and Howard Elliott, president of the Northern Pacific. A plan of the station, which is a large one and of unique design was given in the *Railway Age Gazette* of August 7, 1909, page 365.

The first Northern Pacific passenger station at Tacoma was built on the wharf in 1872, and the passenger station used until recently, which was situated about where the new one stands, was built in 1883.

In his address Mr. Elliott gave some interesting figures regarding the importance of the Northern Pacific to Tacoma. He said that in 1900 an average of 2,017 of the Northern Pacific's employees received their pay in Tacoma, while in 1910 the number was 2,873. Their compensation in 1900 was \$1,181,000, while in 1910 it was \$2,085,000. In 1900 the taxes paid in Pierce county, in which Tacoma is situated, were \$59,000, while in 1910 they were \$192,000. Evidently the Northern Pacific is meeting with difficulties in providing Tacoma with good facilities similar to those which the railways meet elsewhere; for Mr. Elliott said that unfortunately the Northern Pacific could not fully utilize the new passenger facilities until its Point Defiance line is completed; and while it is ready to go on with the construction of that line, it is unable to do so because of difficulties in regard to right-of-way. He protested against unreasonable burdens and restrictions being placed on the road in its efforts to obtain

rights and franchises that are necessary in order to give the public the sort of service it asks for.

Continuing, Mr. Elliott said, in part:

"In the United States, as a whole, there are 409 inhabitants to the mile of road; in the New England states 841 inhabitants; and in the Middle Atlantic states 944 inhabitants, while Washington has only 209 people per mile of railway, showing that your facilities are ample for your present population and business; but with the growth that is bound to come to this country, it will be necessary for the railways to increase their mileage and facilities, or that development will be somewhat checked.

"There are in Washington at the present time 4,188.29 miles of railway, of which the Northern Pacific has built one-half, or 2,098.21 miles. Washington has more railway than Montana, with its much greater area; more than Kentucky or Virginia or Colorado; more railway than any one of the New England states, and four-sevenths as much as all the New England states put together. These figures show clearly that the railways have anticipated the needs of business in this state and have given it even better facilities than some of the older states enjoy.

"The ability of the railways to go on with their work will depend very largely upon the general attitude of the people as a whole toward railway investments and railway management. The railways of the country and the railways of Washington have done a great work and have done their full share of providing transportation, without which agriculture and commerce cannot have its highest success.

"Of late years, however, there has been a tendency to attack the railways and to cripple in many ways the effectiveness of the transportation machine. For instance: In the sessions of the state legislatures which have just terminated in the seven states, Wisconsin and Oregon and Washington, inclusive, there were 221 bills introduced affecting the operation, control and management of the railways. It is true that only a part of these bills were enacted into law, but the spirit that prompts the attack on the railways is naturally disturbing to the owners and managers of properties. It makes them hesitate when they really ought to go forward with confidence that they will be allowed the same chance for profits that are allowed to men engaged in other forms of business.

"We have planned the passenger terminal and our extensive scheme of improvement between Seattle, Tacoma and Portland to provide not only for the greater Tacoma of the future, but for the greater Western Washington and the greater Pacific Northwest.

"The railways have provided the people of this large territory with great tools of commerce and magnificent Puget Sound furnishes an outlet to and from other parts of the country and to foreign nations by water. The use of these tools of commerce and of these waterways by the people should bring about a greater growth in the next 10, 15 and 20 years than in the last 20. Upon the people, however, rests the responsibility of making wise, fair and active use of these wonderful facilities."

The Texan's Fear Allayed.

The train illustrated on this page is the one which was referred to by the correspondent in our issue of May 5, who was so scared by the signal indicating clear that he would have fallen in a fit, but for his intimate knowledge of railway life, which assured him that frequently collisions do not happen, even when the conditions are favorable for them. That signal does not invite a

collision, for the line is *double track*. An officer of the Union Pacific writes to inform us of this fact and to say that next time he will see that both tracks are visible in the picture. We are sorry to have reflected on him; but still we feel almost glad of the occurrence because of this opportunity to print a picture of such a handsome train! Greenhorns from Texas who visit Chicago must keep their eyes peeled!

From Our Most Brilliant Story Paper.

The station was deserted but for one man who seemed absorbed in a newspaper. The ticket agent was apparently thinking of things far away as he deftly juggled coins on the glass plate under the bars of his cage.

The next morning the man with the newspaper was seeming to read it in another station and the ticket agent of the day before was hunting a job. He had been summarily dismissed.

The man with a newspaper was a detective. The ticket agent had been practicing to win facility in working the shadow game, hence his dismissal.

What's the shadow game? A new trick said to have originated in the brain of a Boston subway ticket seller and to have been taught to the other ticket sellers over the country, and this is how it is worked:

The ticket agent arranges a strip of cardboard or black paper so that it will seem to be a shade to keep the bright light out of his eyes. In reality he so arranges it that it leaves the space directly under the change slot brightly illuminated, but casts a deep shadow upon the plate just to the left. Then he practices till he acquires sufficient dexterity to pass out half a dozen coins; make one of them stop well over under the shadow and bunch the others under the bright light.

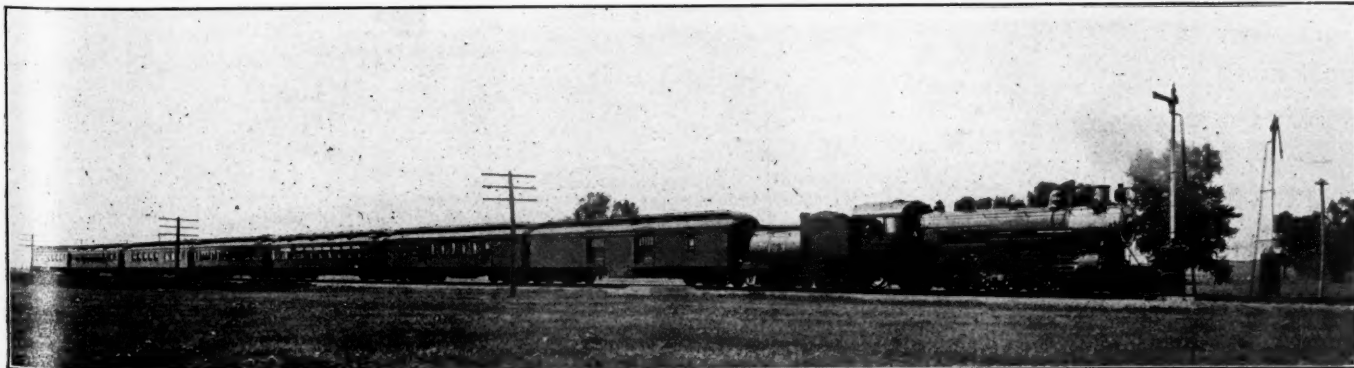
About one person in four will fail to see the nickel or dime in the shadow, and in his haste to get a train will not miss it till it is too late to return. If he does come back the coin is there for him to pick up and he sees no cause to complain. If he does not return the ticket seller adds one more coin to his income.

Some men are said to be so adept at putting coins into the dark that the sharpest eyes fail to detect the trick. A ticket seller at a busy station who was caught by a detective recently confessed that he had been stealing an average of \$3 a day under the shadow.—*New York Sun*.

Natural Gas in Pennsylvania.

Pennsylvania led all states in the value of the production of natural gas in 1909, according to detailed figures published by the United States Geological Survey. The state's output for the year was valued at \$20,475,207, the record value for any state in any year and approximately one-third of the entire value of the natural gas produced in the United States during the year. Pennsylvania's nearest competitor was West Virginia, whose production was valued at \$17,528,565. The quantity of the West Virginia output, however, was considerably higher than that of Pennsylvania, although the value was less.

Since the first gas wells were operated, in 1882, Pennsylvania has uniformly led the other states, although once or twice she has almost lost the place of honor. Her total production, however, has been about half that of the entire United States. In 1882 her production was nearly \$75,000. By 1885 it had increased to \$4,500,000. In 1890 it was \$9,551,025. In 1895 it



Union Pacific Puzzle-Picture.

had decreased to \$5,852,000, and this year Indiana came within a few hundred thousand dollars of attaining first place. By 1900, however, Pennsylvania's production had risen to \$10,215,412. In 1905 it was \$19,197,336, and in 1909 for the first time it passed the \$20,000,000 mark. The price of the Pennsylvania gas ranged from 2½ cents per 1,000 cu. ft. at the wells, for gas sold for manufacturing, to 60 cents per 1,000 cu. ft. for gas sold for domestic use.

An innovation in the gas industry in 1909 was the installation of a few plants in the Pennsylvania oil fields for extracting gasoline from natural gas.

International Master Boilermakers' Association.

The fifth annual convention of the International Boilermakers' Association will be held at the Rome Hotel, Omaha, Nebr., May 23-26. Immediately upon arrival, each member should report to the secretary for registration. The convention will be called to order on Tuesday, May 23, at 10 a. m., and the first session will be given over to addresses and routine business.

The second session, Wednesday, May 24, will open at 9 a. m. with reports by the committees on apprenticeship, standardization of shop tools and equipment, and standardization of pipe flanges and templets, etc. Papers will also be read on radical improvements in boilers and fire boxes; the use of brick arches and arch tubes in fire boxes; and water circulation in marine return tubular and vertical boilers.

The third session, Friday, May 25, will open at 9:30 a. m. with the reports of committees on oxy-acetylene for boiler repairs; the application of tubes and their storage at terminals; staying of crown sheets on radical stay boilers; steel vs. iron tubes; and an investigation concerning the elongation of tube holes in back flue sheet.

The fourth session, Friday, May 26, will open at 9:30 a. m. with the report of committees on law, subjects, and auditing. The remainder of the day will be given over to miscellaneous and unfinished business, selection of next place of meeting and election of officers.

Railway Telegraph Superintendents.

The Association of Railway Telegraph Superintendents has postponed its annual convention to the week beginning June 26. The announcements heretofore issued stated that the meeting was to be held in Boston, June 19-23; but because of the inability of a number of prominent members to be present it has been decided, by a letter vote, to hold the convention in the same city one week later, as above noted. Papers will be presented at the meeting by G. K. Heyer, W. P. Cline, M. E. Launbranch, W. J. Camp and G. A. Cellar.

American Society of Civil Engineers.

At the meeting of the American Society of Civil Engineers, held May 17, a paper entitled *The Present-Day Pumping Engine for Water Works*, by Charles Arthur Hague, M. Am. Soc. C. E., was presented for discussion and illustrated with lantern slides. This paper was printed in the *Proceedings* for March, 1911.

Station Employees.

The Brotherhood of Railway Station Employees held its annual meeting at Bangor, Me., May 9, 10, and 11. The meeting voted to take action toward spreading the organization on the Boston & Albany and the New York, New Haven & Hartford.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; annual convention, May 23-26, Chicago.
AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; next meeting, June 22, 1911, Niagara Falls, N. Y.
AMERICAN ASSOCIATION OF GENERAL PASSENGER AND TICKET AGENTS.—C. M. Burt, Boston, Mass.; next meeting, St. Paul, Minn., Sept. 19, 1911.
AMERICAN ASSOCIATION OF FREIGHT AGENTS.—R. O. Wells, East St. Louis, Ill.; June 20-23, Kansas City, Mo.
AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.—O. G. Fetter, Carew building, Cincinnati, Ohio; 3d Friday of March and September.
AMERICAN ELECTRIC RAILWAY ASSOCIATION.—H. C. Donecker, 29 W. 39th St., New York; October 9-13, Atlantic City, N. J.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York.
AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, C. & N. W., Chicago; Oct. 17-19, 1911, St. Louis, Mo.
AMERICAN RAILWAY ENGINEERING ASSOCIATION.—E. H. Fritch, Monadnock Block, Chicago.
AMERICAN RAILWAY INDUSTRIAL ASSOCIATION.—G. L. Stewart, St. L. S. W. Ry., St. Louis, Mo.
AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 14-16, 1911, Atlantic City, N. J.
AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—O. T. Harroun, Bloomington, Ill.
AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.; June 27-July 1, Atlantic City, N. J.
AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wed., except June and August, New York.
AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—D. J. Haner, 13 Park Row, New York; 3d Tuesday of each month, New York.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York; next convention, May 30-June 2, Pittsburgh, Pa.
ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago.
ASSOCIATION OF RAILWAY CLAIM AGENTS.—J. R. McSherry, C. & E. I., Chicago; May 24-26, Montreal, Can.
ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreuccetti, C. & N. W. Ry., Chicago; semi-annual, June 16-17, Washington, D. C.
ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, 135 Adams St., Chicago; June 19, 1911, Boston, Mass.
ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Pl., New York; June 20-21, Cape May City, N. J.
CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tuesday in month, except June, July and Aug., Montreal.
CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursdays, Montreal.
CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.
CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Thurs. in Jan., and 2d Fri. in March, May, Sept., Nov., Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—D. F. Jurgensen, 116 Winter St., St. Paul, Minn.; 2d Monday, except June, July and Aug., St. Paul.
ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.
FREIGHT CLAIM ASSOCIATION.—Warren F. Taylor, Richmond, Va.; June 21, St. Paul, Minn.
GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—H. D. Judson, 209 East Adams St., Chicago; Wed. preceding 3d Thurs., Chicago.
INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York; May 23-26, Omaha, Neb.
INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, rue de Louvain, 11 Brussels; 1915, Berlin.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago.
INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; July 25-27, Chicago.
INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio.
IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August, Des Moines.
MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago; June 19-21, 1911, Atlantic City, N. J.
MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION, OF UNITED STATES AND CANADA.—A. P. Dane, B. & M., Reading, Mass.; Sept. 12-15, 1911, Atlantic City, N. J.
NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.
NORTHERN RAILWAY CLUB.—C. L. Kennedy, C. & M. & St. P., Duluth, Minn.; 4th Saturday, Duluth.
OMAHA RAILWAY CLUB.—H. H. Maulick, Barker Block, Omaha, Neb.; second Wednesday.
RAILROAD CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.
RAILWAY CLUB OF PITTSBURGH.—C. W. Alleman, P. & L. E., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.
RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Bethlehem, Pa.; June 13, New York; annual, Oct. 10, Colorado Springs, Colo.
RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio; annual, May 22-24, 1911, Milwaukee, Wis.
RICHMOND RAILROAD CLUB.—F. O. Robinson, Richmond, Va.; 2d Monday, except June, July and August.
ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; September 12-15, St. Louis, Mo.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis.
SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago; Sept. 12-14, St. Paul, Minn.
SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.
SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant bldg., Atlanta, Ga.; 3d Thurs., Jan., March, May, July, Sept., Nov., Atlanta.
TOLEDO TRANSPORTATION CLUB.—L. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday, Toledo.
TRAFFIC CLUB OF CHICAGO.—Guy S. McCabe, La Salle Hotel, Chicago; meetings monthly, Chicago.
TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August, New York.
TRAFFIC CLUB OF PITTSBURGH.—T. J. Walters, Oliver building, Pittsburgh, Pa.; meetings monthly, Pittsburgh.
TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago; annual, June 20, 1911, Baltimore, Md.
TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; first Saturday after first Wednesday.
TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, L. S. & M. S., Detroit, Mich.; meetings monthly.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.; annual, August 29-September 1, Chicago.
WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.
WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.
WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago; 1st Wednesday in month except July and August, Chicago.
WOOD PRESERVERS' ASSOCIATION.—F. J. Angier, First National Bank bldg., Chicago.

Traffic News.

New through passenger service was inaugurated by the Chicago, Rock Island & Pacific on May 14 between St. Paul, Minn., and Des Moines, Iowa, and between Memphis, Tenn., and California points.

The decision to make an extra charge for all pieces of baggage, the greatest dimension of which exceeds 40 in., has been reaffirmed by the Western Passenger Association and the Central Passenger Association.

The Bangor & Aroostook in April carried 1,141,386 bushels of potatoes out of Aroostook county, Maine. And since the beginning of the last harvest the quantity of potatoes which was moved through Augusta was 9,835,677 bushels. This quantity shows an increase of 1,474,573 bushels as compared with the previous season.

"The road improvement train," which is being run by the Southern Railway over its lines in Alabama, Mississippi and other states, appears to have been enlisted for the summer, schedules having been laid out which will last until October. Next week, during the Good Roads convention at Birmingham, the train with its exhibits will be on exhibition continuously in that city.

The "Spud special," a fast freight now running between Wharton, Texas, and Chicago, is carrying to the northern city the spring Irish potato crop, and it is expected that by this means, before the middle of June, about \$2,000,000 worth of potatoes will be sent out of Texas. The train runs over the Houston & Texas Central, the Texas Midland and the St. Louis & San Francisco.

The Southern Railway, while urging the farmers of the South to diversify their crops and to raise cattle, at the same time takes care to do everything possible in the direction of increasing the yield of cotton per acre; and at the stations of the company and other places has posted placards setting forth the 10 principal points to be kept in mind by a farmer desiring to obtain the most plentiful crop and achieve the greatest success in the cultivation of this product.

Beginning May 28, the "Overland Limited" of the Union Pacific-Southern Pacific, which now leaves Chicago daily via the Chicago & North Western to Omaha at 7 p. m., and arrives in San Francisco at 5:28 p. m. of the third day, will leave Chicago an hour and a half later and reach San Francisco, Cal., at 2:28 p. m. of the third day, thus cutting 4½ hours from its schedule. Eastbound the train will leave San Francisco at 10:20 a. m. instead of 10:40 a. m., and arrive in Chicago at 9:10 a. m. of the third day instead of at 1 p. m., as under the present schedule.

The Chicago & North Western, the Chicago, Rock Island & Pacific, the Chicago, Milwaukee & St. Paul, the Chicago, St. Paul, Minneapolis & Omaha and the Minnesota & International have taken formal action to enjoin the enforcement of the 2-cent passenger fare and the reduced freight and commodity rates in Minnesota. This will make applicable to these roads whatever ruling is made by the United States Supreme Court on the appeal from Judge Sanborn's recent decision, which directly affected only the Northern Pacific, Great Northern and Minneapolis & St. Louis, and will enable them to raise their rates on July 1.

In April, 1911, 374 vessels passed through the canals at Sault Ste. Marie, of which 183 passed through the United States canal, and 191 through the Canadian canal. The total freight on all these vessels was 792,587 tons; 181,736 tons of freight being carried through the United States canal and 610,851 tons through the Canadian canal. Of the total tonnage, 370,325 tons was eastbound and 422,262 tons westbound. The principal eastbound commodity was wheat, of which 5,664,653 bushels moved eastbound in April. The principal westbound tonnage was furnished by soft coal. The tonnage of this commodity moving in a westbound direction during April amounted to 286,468 tons.

INTERSTATE COMMERCE COMMISSION.

The commission is to make a general inquiry into the rates on wool and hides in connection with proposed increases of rates from all of the principal points of origin of this traffic west of the Mississippi river.

The commission has modified its recent order permitting the Carolina, Clinchfield & Ohio to disregard the long and short haul rule in making rates on coal from the mines in Virginia to tidewater at Charleston for export. Under the modified order the low rates must not be applied to coal to be loaded into ships' bunkers.

The special work for which Professor Henry C. Adams was employed by the Interstate Commerce Commission soon after the passage of the Hepburn Act, to inaugurate a system of uniform bookkeeping and accounting, having been concluded, he will retire from the work of the commission, leaving Charles A. Lutz, chief examiner of accounts, in charge of the work in the division of carrier's accounts, and Professor William J. Myers, statistician, in charge of the work in the division of statistics.

Complaint Dismissed.

Georgia Fruit Exchange et al. v. Southern Railway et al. Opinion by Commissioner Harlan:

Considering the methods practiced by growers in Georgia in picking and packing peaches and loading the crates into cars for the northern markets, and the difficulties of refrigerating peaches in transit, it is held that no grounds are shown for requiring the defendants to reduce their minimum carload weight on a 40-foot car from 22,500 pounds, or 535 crates, to 19,000 pounds, or 448 crates, as contended by the complainants. (20 I. C. C., 623.)

Lawrence-Wardenburg Co. v. Southern Pacific et al., F. D. Ogden v. Southern Pacific et al., New Orleans Board of Trade, Ltd. v. Southern Pacific et al. Opinion by Commissioner Harlan:

Following the conclusions reached in *Commercial Club of Omaha v. Southern Pacific*, complaints, seeking reparation for alleged unreasonable rates collected on shipments of lima beans from California points to New Orleans and to points in Texas, Oklahoma, Colorado, and New Mexico, are dismissed. (20 I. C. C., 638.)

Commercial Club of Omaha v. Southern Pacific et al. Opinion by Commissioner Harlan:

The long continuance of a rate voluntarily established and not published under the compelling influence of competitive conditions is in itself evidence of no little weight of its reasonableness; but the long continuance of a rate largely loses its value as evidence in a case involving an advanced rate for the same service, when it is shown that the prior and lower rate was the result of the influence of a strong movement by water.

The record presents no grounds for a finding that a rate of 85 cents per 100 pounds on lima beans in carloads from California to points in the territory extending from Colorado to the Atlantic seaboard is an excessive rate when considered as a blanket rate, or any grounds for taking Omaha out of a blanket territory, with which it has long been associated in this and other traffic without protest from any quarter, by a finding that it is an excessive rate to that particular point. Should it appear, however, from judicial proceedings now pending that the power of the commission to deal with rates applicable to so extensive a group is a limited one and not coextensive with the power of the carriers to establish group rates of such broad application, nothing said here must be understood as indicating that the commission would be satisfied with an 85-cent rate to Omaha.

The order heretofore entered herein vacated. (20 I. C. C., 631.)

Regulation of Telephone Rates.

William D. Shoemaker v. Chesapeake & Potomac Telephone Co. Opinion by Commissioner Harlan:

As between subscribers to a telephone service who are similarly situated, nothing but a difference in the service rendered or facilities furnished can justify a difference in the charges exacted. The fact that a few subscribers connected with a new exchange were previously connected with another exchange which was abandoned by the defendant from motives of economy in management and efficiency of service is not such a dissimilarity of

circumstances and conditions as to warrant the exaction of the current charges from a new subscriber while for the same service and facilities the old subscribers continue to pay the lower charges formerly exacted at the old exchange.

The contracts between such old subscribers and the defendant, even though valid when made, can not, after congress has undertaken to regulate the rates and practices of telephone companies, be accepted as now justifying different charges as between different subscribers similarly situated, such undue discriminations being forbidden by the act. (20 I. C. C., 614.)

Monthly Revenues and Expenses of Railways.

The two tables which we publish herewith, giving the revenues and expenses of railways for March, complete, the figures for March for about three-quarters of the roads reporting to the Interstate Commerce Commission; and the page table which we will publish June 2 will give the figures of the other roads which report to the Interstate Commerce Commission. Heretofore, we have published the figures for one-quarter of the roads each week, but by publishing the figures for half of them at once and then omitting one week it is possible to give the figures for nearly all of the important roads by the 17th or 18th of each month.

STATE COMMISSIONS.

Two railway commission bills, both of which provide for an enlargement of the powers of the present commission and make it an elective instead of an appointive body, have passed the Illinois house of representatives. The senate passed a bill previously passed by the house, placing express companies in the state under the jurisdiction of the commission.

Assistant Attorney General E. B. Robertson, of Texas, has advised the Texas commission that its rule that no stock shall be authorized and ordered registered by the commission on a railway until the line has been built and valued by the commission, is not sustained by law. He holds that a road has the right to present stock to the commission and have a record made of it, and also register it in the office of the secretary of state and sell it, without having built any road.

The Oklahoma Corporation Commission has announced that instead of continuing the fight to dissolve the injunction, recently upheld by the United States Circuit Court of Appeals, restraining the commission from enforcing its orders for reductions in freight rates, it will order new rates, which, to avoid the possibility of putting the commission in contempt of court, will be made either a little higher or a little lower than those in its original orders. A hearing on the proposed new rates on grain, grain products and hay will be held the latter part of May.

Hearings before the Washington Railway Commission regarding the adjustment of freight rates between competing communities in that state were closed on May 11. During the hearings J. G. Woodworth, traffic manager of the Northern Pacific, testified that if the rates from the coast to Spokane were reduced, corresponding reductions would have to be made from Atlantic seaboard points to Spokane if the railways are to get any of the long-haul traffic, as otherwise much of the traffic from the eastern part of the United States to Spokane would be diverted to the water routes. The increased operating expenses due to the working of the Washington "full crew" law was one of the items introduced by the roads to justify their present rates, the figures of the Northern Pacific showing that the increase in its operating expenses on this account will amount to from \$175,000 to \$200,000 annually.

The Railroad Commission of Louisiana has fined the Louisiana & Northwest \$2,000 for failure to obey its order directing the improvement of freight and passenger service. The Louisiana & Northwest runs from McNeil, Ark., to Natchitoches, La., 121 miles, 96 miles of the road being in Louisiana. The commission took evidence from shippers and people who live on the line, and this evidence showed that the freight service had been of a very poor nature for a long time; delays to freight had been frequent and sometimes had amounted to as much as 30 days. In 1907 the commission ordered the railway to run at least one passenger train each way daily over its line in Louisiana and one freight train each way daily. If anything, the freight service

during the past few months has been worse than it was when this order was issued. The excuse that the company has made is that its financial condition is such that it is doing all that it can do. The commission, however, holds that a railway company must provide proper and sufficient facilities for transportation, and its failure to do so is of itself a violation of its obligations.

COURT NEWS.

The decision of the United States Supreme Court, dissolving the Standard Oil Company, is reported on another page.

At Pittsburgh, May 13, the Pennsylvania Railroad was fined \$1,000 for violation of the Interstate Commerce law in failure to adhere to tariffs in the collection of demurrage at Johnstown, Pa., on a carload of freight from Ashtabula, Ohio, for the Cambria Steel Company.

The Pittsburgh & Lake Erie, which was indicted last month by a special federal grand jury on 20 counts, ten charging failure to comply with tariffs filed with the Interstate Commerce Commission and ten charging unlawful granting of concessions in rates, has been fined \$1,000 by the United States District Court at Pittsburgh, the fine being imposed on the first count only. The road's attorney stated that the violation of law was merely technical and that certain records relating to the matter had been destroyed in a flood.

In the Federal Court at Kansas City, May 12, Judge Pollock decided against the Government in its suit against trainmen of the Missouri Pacific on the division between Kansas City and Hoisington, Kan. He sustained a demurrer filed by the attorney for the trainmen, holding that no provision of the Interstate Commerce law had been violated. His decision quashed the indictments returned March 7 by a Federal Grand Jury against twenty-four employees of the Missouri Pacific. The company learned that certain conductors, porters and brakemen were carrying passengers for less than the published tariff rates and were keeping the money. Instead of prosecuting the men the railway turned the case over to the United States District Attorney and the men were indicted.

[Section 10 of the Interstate Commerce Act says that any common carrier, or, if it is a corporation, any person employed by it, who shall wilfully do any thing in this Act prohibited shall be deemed guilty of a misdemeanor and subject to a fine of \$5,000; and, if the offense be unlawful discrimination in rates or fares, to imprisonment for two years, also. On a prominent eastern road this provision of the law is posted in the passenger cars.—Editor.]

The Supreme Court of the United States on Monday last again sustained the safety appliance laws, as making it absolutely the duty of interstate carriers to keep in repair automatic couplers and other appliances prescribed by law. In the suit of Delk, a brakeman who was injured on the St. Louis & San Francisco while manipulating a defective coupler, the railway claimed that in exercising reasonable diligence, in the matter of repairs, it had done its full duty. The Court of Appeals for the sixth circuit, decided in favor of the railway, but the Supreme court now reverses this, deciding for Delk. According to the press despatches, this decision settles also three other cases appealed to the Supreme court. In a case against the Chicago, Burlington & Quincy, the road had claimed that the imposition of a fine for violation of the law was unreasonable because the company did not know that the cars in question were out of repair and had no intention of violating the law. In a case against the Colorado & Northwestern, a narrow gauge road, engines and cars were used having the old fashioned link and pin (non-automatic) couplers. This road lies wholly within Boulder county and the defense of the company was that it had no arrangement for a continuous transportation with the connecting carrier, but the Supreme court holds that traffic may be interstate in spite of the absence of such an arrangement. The fourth case was one against the Southern Railway, where the defense was that the defective car was carrying a shipment which originated and ended within the state of Alabama. The court held that the defect in the car was a violation of the law because the car was sometimes used for interstate commerce and therefore was an instrumentality of interstate commerce.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF MARCH, 1911. (SEE ALSO ISSUE MAY 12.)

Name of road.	Mileage operated at end of period.	Operating revenues.			Operating expenses.			Net operating revenue (or loss).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decrease) in comp. with last year.
		Freight.	Passenger.	Total.	Way and structures, equipment.	Traffic.	Trans- portation.					
Alabama Great Southern	277	\$213,559	\$7,011	\$220,570	\$18,732	\$1,128	\$18,732	\$19,861	\$180	\$13,241	\$35,758	\$79,470
Atlanta, Birmingham & Atlantic	309	\$218,725	\$81,111	\$299,836	\$23,255	\$9,448	\$14,807	\$23,255	—	10,500	\$13,755	\$11,875
Baltimore & Ohio System	4,434	\$2,137,297	\$1,083,233	\$3,220,530	\$653,914	\$130,329	\$523,585	\$653,914	—	195,271	\$2,035,259	\$438,231
Bangor & Aroostook	627	\$258,584	\$3,260	\$261,844	\$36,461	\$8,612	\$27,849	\$36,461	—	2,524	\$128,815	\$48,604
Bessemer & Lake Erie	204	\$243,380	\$20,943	\$264,323	\$453,204	\$7,550	\$146,062	\$453,204	—	6,000	\$88,155	\$58,953
Central New England	277	\$213,559	\$7,011	\$220,570	\$18,732	\$1,128	\$18,732	\$19,861	—	10,500	\$35,758	\$79,470
Central of Georgia	1,915	\$64,894	\$264,074	\$728,968	\$138,737	\$31,764	\$39,560	\$138,737	6,623	45,470	\$365,278	\$43,463
Central Vermont	411	\$260,524	\$2,747	\$263,271	\$28,897	\$7,171	\$21,726	\$28,897	297	77,235	\$77,235	\$—
Chesapeake & Ohio	1,948	\$1,962,285	\$384,135	\$2,346,420	\$240,651	\$43,515	\$73,281	\$240,651	3,948	93,250	\$675,668	\$484,481
Chesapeake & Ohio of Indiana	285	\$104,494	\$13,880	\$118,374	\$18,896	\$4,404	\$14,492	\$18,896	46	3,790	\$47,228	\$—
Chicago & Alton	1,025	\$691,429	\$318,761	\$1,010,190	\$96,204	\$48,255	\$48,000	\$96,204	—	37,000	\$360,069	\$8,843
Chicago & Erie	269	\$386,763	\$163,600	\$550,363	\$38,929	\$20,033	\$18,896	\$38,929	—	11,387	\$69,787	\$5,542
Chicago, Indiana & Southern	329	\$305,805	\$19,700	\$325,505	\$33,605	\$7,947	\$25,658	\$33,605	—	13,900	\$89,820	\$53,540
Chicago, Indianapolis & Louisville	616	\$340,106	\$126,757	\$466,863	\$61,750	\$16,482	\$45,268	\$61,750	—	22,500	\$133,084	\$7,862
Chicago, Milwaukee & Puget Sound	1,980	\$1,200,350	\$137,549	\$1,337,899	\$135,346	\$28,200	\$107,146	\$135,346	3,976	50,306	\$625,571	\$183,035
Chicago, Milwaukee & St. Paul	7,511	\$719,707	\$1,049,440	\$1,769,147	\$412,257	\$108,463	\$210,794	\$412,257	9,136	226,616	\$1,550,298	\$36,505
Chicago, Rock Island & Gulf	471	\$159,850	\$23,346	\$183,196	\$18,806	\$8,182	\$10,624	\$18,806	—	19,600	\$257,070	\$57,613
Cincinnati, New Orleans & Texas Pacific	337	\$402,293	\$126,387	\$528,680	\$73,033	\$19,424	\$53,609	\$73,033	—	21,800	\$240,780	\$289,324
Cleveland, Akron & Columbus	212	\$158,854	\$42,016	\$200,870	\$36,452	\$3,327	\$33,125	\$36,452	—	8,500	\$53,626	\$1,041
Cleveland, Cincinnati, Chic. & St. Louis	1,979	\$1,730,339	\$584,021	\$2,314,360	\$255,219	\$77,372	\$1,074,842	\$255,219	—	80,000	\$546,062	\$157,617
Colorado & Southern	1,173	\$496,405	\$7,807	\$504,212	\$64,169	\$9,862	\$54,307	\$64,169	—	24,022	\$172,437	\$63,463
Cumberland Valley	162	\$173,972	\$44,518	\$218,490	\$28,109	\$4,056	\$24,053	\$28,109	354	5,141	\$17,129	\$47,371
Delaware & Hudson Co.—R. R. Dept.	819	\$1,583,727	\$180,364	\$1,764,091	\$182,488	\$16,525	\$165,963	\$182,488	—	41,646	\$637,221	\$86,253
Duluth, South Shore & Atlantic	611	\$153,842	\$1,272	\$155,114	\$27,535	\$9,265	\$18,270	\$27,535	—	6,240	\$18,290	\$12,049
El Paso & Southwestern Co.	901	\$488,748	\$80,363	\$569,111	\$69,932	\$10,977	\$58,955	\$69,932	—	32,803	\$228,226	\$48,081
Elgin, Joliet & Eastern	831	\$27,462	\$11	\$27,473	\$22,004	\$4,197	\$17,807	\$22,004	—	13,241	\$32,369	\$20,076
Evansville & Terre Haute	310	\$137,666	\$56,506	\$194,172	\$21,265	\$5,195	\$16,070	\$21,265	—	7,111	\$131,256	\$86,009
Florida East Coast	583	\$350,550	\$273,588	\$624,138	\$42,908	\$10,339	\$32,569	\$42,908	—	7,783	\$26,029	\$411,037
Fort Worth & Denver City	454	\$209,271	\$114,882	\$324,153	\$39,306	\$5,445	\$33,861	\$39,306	—	14,653	\$256,823	\$95,342
Galveston, Harrisburg & San Antonio	1,338	\$14,231	\$27,830	\$42,061	\$19,695	\$3,993	\$15,702	\$19,695	—	31,482	\$68,358	\$23,759
Georgia	307	\$220,982	\$64,734	\$285,716	\$30,967	\$41,012	\$12,955	\$30,967	—	14,085	\$84,758	\$8,426
Grand Rapids & Indiana	587	\$301,377	\$115,059	\$416,436	\$51,806	\$10,778	\$41,028	\$51,806	—	23,351	\$78,593	\$12,092
Hocking Valley	350	\$366,930	\$60,890	\$427,820	\$45,251	\$9,553	\$35,698	\$45,251	—	24,725	\$62,214	\$210,745
Houston & Texas Central	789	\$326,711	\$119,587	\$446,298	\$66,199	\$12,424	\$53,775	\$66,199	—	13,327	\$83,127	\$6,361
Illinois Central	4,574	\$3,822,612	\$1,021,289	\$4,843,901	\$563,317	\$112,862	\$1,865,690	\$563,317	—	238,123	\$1,131,569	\$546,277
International & Great Northern	1,159	\$113,323	\$176,844	\$290,167	\$16,913	\$19,047	\$32,343	\$16,913	—	20,000	\$93,790	\$32,627
Iowa Central	559	\$272,245	\$44,364	\$316,609	\$30,941	\$45,622	\$16,317	\$30,941	—	9,689	\$95,559	\$10,358
Kansas & Oklahoma	175	\$204,488	\$26,365	\$230,853	\$20,621	\$4,293	\$16,328	\$20,621	—	18,000	\$9,501	\$15,733
Lake Erie & Western	866	\$368,606	\$60,231	\$428,837	\$70,213	\$12,723	\$57,490	\$70,213	—	53,333	\$20,905	\$63,409
Long Island	395	\$271,498	\$391,882	\$663,380	\$69,706	\$13,526	\$56,180	\$69,706	—	24,814	\$158,629	\$32,293
Minneapolis & St. Louis	1,027	\$227,665	\$92,534	\$320,199	\$28,277	\$11,125	\$17,152	\$28,277	—	13,333	\$17,332	\$15,615
Missouri, Kansas & Texas	1,737	\$893,363	\$384,279	\$1,277,642	\$155,347	\$40,231	\$115,116	\$155,347	—	350	\$370,866	\$9,318
Missouri, Kansas & Texas of Texas	1,348	\$413,465	\$136,999	\$550,464	\$79,151	\$22,334	\$56,817	\$79,151	—	336	\$22,500	\$23,966
Missouri Pacific	3,921	\$1,382,978	\$355,744	\$1,738,722	\$300,314	\$55,611	\$992,211	\$300,314	—	2,885	\$152,990	\$50,562
Mobile & Ohio	1,114	\$755,450	\$107,993	\$863,443	\$117,314	\$31,424	\$85,890	\$117,314	—	288,495	\$288,495	\$50,562
Morgan's La. & Texas R. R. & S. Co.	404	\$250,360	\$91,000	\$341,360	\$55,157	\$12,102	\$43,055	\$55,157	—	18,756	\$65,473	\$19,615
Nashville, Chattanooga & St. Louis	1,230	\$854,198	\$212,707	\$1,066,905	\$207,379	\$39,333	\$168,046	\$207,379	—	240,417	\$240,417	\$26,588
New Orleans & Northeastern	196	\$230,023	\$48,280	\$278,303	\$38,387	\$10,144	\$28,243	\$38,387	—	9,250	\$91,520	\$30,359
New Orleans, Mobile & Chicago	404	\$128,191	\$27,260	\$155,451	\$23,294	\$2,759	\$20,535	\$23,294	—	4,267	\$60,971	\$7,381
New York, Chicago & St. Louis	562	\$805,336	\$23,777	\$829,113	\$125,615	\$46,188	\$79,427	\$125,615	—	29,600	\$198,533	\$160,805
New York, Ontario & Western	546	\$35,892	\$8,419	\$44,311	\$3,046	\$9,461	\$32,473	\$3,046	—	17,500	\$144,342	\$65,511
New York, Philadelphia & Norfolk	112	\$2,600	\$8,509	\$11,109	\$2,654	\$4,024	\$14,750	\$2,654	—	7,500	\$47,620	\$21,075
New York, Susquehanna & Western	112	\$191,977	\$4,341	\$196,318	\$18,612	\$1,718	\$16,894	\$18,612	—	11,771	\$109,934	\$1,173
Norfolk Southern	608	\$234,704	\$1,438	\$236,142	\$30,137	\$4,730	\$25,407	\$30,137	—	5,900	\$199,846	\$1,173
Peoria & Eastern	351	\$194,379	\$1,618	\$195,997	\$34,839	\$5,179	\$39,018	\$34,839	—	9,500	\$35,881	\$47,975
Philadelphia & Reading	1,022	\$3,012,947	\$16,033	\$3,028,980	\$284,727	\$38,727	\$1,223,997	\$284,727	—	84,142	\$1,291,429	\$92,460
Pittsburgh & Lake Erie	191	\$1,068,225	\$12,619	\$1,080,844	\$123,657	\$16,420	\$107,237	\$123,657	—	30,000	\$587,915	\$241,039
Rutland	468	\$149,461	\$75,507	\$224,968	\$28,194	\$5,736	\$22,458	\$28,194	—	9,538	\$39,039	\$19,613
St. Louis & San Francisco	4,732	\$2,336,676	\$82,550	\$2,419,226	\$347,440	\$78,108	\$1,250,959	\$347,440	—	153,814	\$1,105,245	\$68,198
St. Louis, Brownsville & Mexico	501	\$90,557	\$7,192	\$97,749	\$166,786	\$2,525	\$64,313	\$166,786	—	4,500	\$37,443	\$4,186
St. Louis, Iron Mountain & Southern	3,313	\$1,725,885	\$495,198	\$2,221,083	\$201,830	\$53,186	\$833,370	\$201,830	—	78,916	\$887,281	\$11,938
St. Louis, Southwestern of Texas	797	\$336,661	\$102,590	\$439,251	\$75,797	\$25,982	\$49,815	\$75,797	—	21,574	\$249,390	\$4,319
St. Louis, Southwestern of Texas	703	\$230,872	\$64,751	\$295,623	\$39,918	\$11,697	\$28,221	\$39,918	—	10,000	\$54,020	\$32,036
San Pedro, Los Angeles & Salt Lake	1,105	\$369,733	\$192,044	\$561,777	\$128,388	\$27,740	\$100,648	\$128,388	—	18,335	\$26,687	\$17,053
Seaboard Air Line	3,046	\$1,600,476	\$41,466	\$1,641,942	\$253,819	\$58,103	\$736,455	\$253,819	—	72,000	\$812,933	\$100,696
Southern Pacific Co.	6,187	\$4,191,691	\$2,484,054	\$6,675,745	\$940,468	\$167,074	\$2,173,642	\$940,468	—	4,528,872	\$2,437,824	\$441,042
Spokane, Portland & Seattle	551	\$272,595	\$130,535	\$403,130	\$50,142	\$6,986	\$43,156	\$50,142	—	42,200	\$165,528	\$83,588
Texas & Pacific	1,885	\$181,551	\$140,058	\$321,609	\$30,147	\$18,614	\$11,533	\$30,147	—	44,764	\$84,091	\$192,597
Toledo & Ohio Central	444	\$302,634	\$34,707	\$337,341	\$18,437	\$7,163	\$11,274	\$18,437	—	20,344	\$65,336	\$60,857
Toledo, St. Louis & Western	451	\$257,325	\$34,270	\$291,595	\$34,514	\$10,693	\$23,821	\$34,514	—	14,550	\$77,057	\$20,422
Virginian	474	\$272,698	\$17,982	\$290,680	\$32,592	\$5,308	\$27,284	\$32,592	—	17,600	\$95,849	\$36,988
Wabash	2,515	\$1,700,960	\$499,569	\$2,199,529	\$232,642	\$70,921	\$1,068,566	\$232,642	—	2,668	\$394,070	\$310,710
West Jersey & Seashore	353	\$153,870	\$23,671	\$177,541	\$40,019	\$10,260	\$29,759	\$40,019	—	11,245	\$26,227	\$27,967
Wheeling & Lake Erie	457	\$430,396	\$40,351	\$470,747	\$109,105	\$7,538	\$101,643	\$109,105	—	13,468	\$389,055	\$94,538
Xazoo & Mississippi Valley	1,372	\$632,573	\$305,362	\$937,935	\$908,823	\$14,720	\$315,985	\$908,823	—	24,222	\$225,430	\$60,050

REVENUES AND EXPENSES OF RAILWAYS.

NINE MONTHS OF FISCAL YEAR, 1911. (SEE ALSO ISSUE OF MAY 12.)

Name of road.	Mileage operated at end of period.	Operating revenues				Operating expenses				Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decrease) last year.		
		Freight.	Passenger.	Inc. misc.	Total.	Way and structures.	Maintenance of equipment.	Traffic.	Trans- portation.						General.	Total.
Alabama Great Southern	309	\$2,282,006	\$852,828	\$3,425,897	\$6,707,431	\$432,640	\$788,814	\$93,039	\$1,049,358	\$82,648	\$2,446,499	\$2,446,499	—	\$122,317	\$2,568,816	—
Atlanta, Birmingham & Atlantic	662	1,387,281	1,387,281	662,562	3,437,124	264,163	334,123	135,304	790,397	82,645	1,606,632	1,606,632	—	99,645	1,706,277	—
Baltimore & Ohio—System	4,434	50,680,045	11,387,255	66,277,040	128,344,340	7,681,706	12,291,161	1,491,254	25,499,909	1,384,538	48,098,788	48,098,788	—	84,713	48,183,501	—
Bangor & Aroostook	627	1,759,441	484,351	2,343,792	3,034,913	392,081	281,562	30,609	740,738	98,135	1,931,123	1,931,123	—	20,678	1,951,801	—
Bessemer & Lake Erie	204	5,104,075	276,031	5,480,106	5,756,137	648,769	1,223,681	69,643	1,572,483	104,563	3,619,139	3,619,139	—	80,684	3,700,823	—
Central New England	277	1,448,821	266,503	2,215,324	2,482,827	442,178	201,849	16,641	684,902	43,792	1,889,362	1,889,362	—	111,000	2,000,362	—
Central of Georgia	1,915	6,697,091	2,654,480	10,221,197	13,442,671	1,340,867	1,660,682	293,024	3,233,459	364,415	6,882,447	6,882,447	—	411,958	7,294,405	—
Central Vermont	411	1,932,093	801,218	2,734,021	3,534,041	350,759	427,986	72,053	2,897,976	72,053	2,897,976	2,897,976	—	99,116	2,997,092	—
Chesapeake & Ohio	1,948	18,628,992	3,992,124	23,601,995	26,594,119	2,669,084	4,464,384	402,608	7,056,629	544,839	15,137,543	15,137,543	—	7,711,085	22,848,628	—
Chesapeake & Ohio of Indiana	285	908,821	206,878	1,115,699	1,115,699	285,539	261,417	33,145	646,630	45,827	1,292,558	1,292,558	—	34,110	1,326,668	—
Chicago & Alton	1,025	6,987,253	3,282,576	11,075,741	18,163,290	1,430,731	1,816,290	333,678	4,168,110	311,360	8,080,178	8,080,178	—	16,696	8,096,874	—
Chicago & Erie	269	3,033,920	602,966	3,636,886	3,636,886	435,043	821,922	182,954	1,078,782	80,865	3,335,566	3,335,566	—	102,038	3,437,604	—
Chicago, Indiana & Southern	329	2,465,832	216,642	2,682,474	2,682,474	377,300	550,132	78,442	1,078,782	80,865	3,335,566	3,335,566	—	102,038	3,437,604	—
Chicago, Indianapolis & Louisville	616	3,015,454	1,179,443	4,194,897	4,194,897	594,672	1,139,468	150,777	3,183,607	134,493	3,183,607	3,183,607	—	202,500	3,386,107	—
Chicago, Milwaukee & Puget Sound	1,980	9,587,053	1,075,278	10,662,331	10,662,331	692,976	1,139,468	265,607	3,183,607	134,493	3,183,607	3,183,607	—	202,500	3,386,107	—
Chicago, Milwaukee & St. Paul	7,511	34,638,174	10,740,356	45,378,530	56,118,886	6,267,687	6,993,835	900,784	21,828,772	812,267	36,863,345	36,863,345	—	1,982,851	38,846,196	—
Chicago, Rock Island & Gulf	4,715	1,567,175	539,249	2,296,424	2,296,424	333,360	1,683,536	181,387	813,750	73,144	1,470,847	1,470,847	—	14,731	1,485,581	—
Cincinnati, New Orleans & Texas Pacific	317	5,831,872	1,294,265	7,126,137	7,126,137	724,145	1,383,359	185,082	2,017,038	161,324	1,470,666	1,470,666	—	18,500	1,489,166	—
Cleveland, Akron & Columbus	212	1,448,825	433,022	1,871,847	1,871,847	338,231	335,120	27,444	677,011	525,771	1,826,975	1,826,975	—	733,548	2,560,523	—
Cleveland, Cincinnati, Chic. & St. Louis	1,979	15,234,500	6,049,056	21,283,556	21,283,556	2,991,374	4,028,669	760,409	9,954,389	1,513,681	18,266,915	18,266,915	—	67,021	18,333,936	—
Colorado & Southern	1,173	5,573,750	1,198,844	7,166,604	7,166,604	814,321	1,391,792	107,677	2,268,082	201,463	4,783,335	4,783,335	—	11,963	4,795,300	—
Cumberland Valley	162	1,718,922	486,883	2,311,135	2,311,135	318,093	306,974	42,026	740,668	60,718	1,468,479	1,468,479	—	2,592	1,471,071	—
Delaware & Hudson Co.—R. R. Dept.	819	12,892,002	2,266,095	15,629,460	15,629,460	1,177,660	2,208,751	197,046	5,514,800	368,875	9,468,032	9,468,032	—	12	9,480,114	—
Duluth, South Shore & Atlantic	611	1,503,103	725,570	2,228,673	2,228,673	338,356	267,561	90,474	1,211,559	62,885	1,671,434	1,671,434	—	6,307	1,677,741	—
El Paso & Southwestern Co.	901	4,459,781	729,633	5,189,414	5,189,414	686,548	730,449	96,619	1,565,973	205,165	3,284,754	3,284,754	—	10,435	3,295,189	—
Elgin, Joliet & Eastern	831	5,671,404	69	6,010,235	6,010,235	753,806	1,209,264	36,554	1,954,909	151,650	4,106,183	4,106,183	—	145,800	4,251,983	—
Evansville & Terre Haute	310	1,295,868	551,738	2,047,606	2,047,606	249,409	272,884	49,629	662,510	58,343	1,292,755	1,292,755	—	6,903	1,300,658	—
Florida East Coast	583	1,499,278	1,127,326	2,626,604	2,626,604	387,125	411,430	61,607	972,009	70,084	1,902,255	1,902,255	—	127,141	2,029,396	—
Fort Worth & Denver City	454	2,618,027	1,284,843	3,902,870	3,902,870	398,960	664,469	53,784	1,292,593	132,537	2,542,343	2,542,343	—	11,860	2,554,203	—
Galveston, Harrisburg & San Antonio	1,338	5,849,039	2,123,722	8,397,132	8,397,132	1,091,072	1,287,303	252,720	3,069,491	257,887	5,938,473	5,938,473	—	22,290	6,060,763	—
Georgia	307	1,689,595	679,412	2,369,007	2,369,007	315,996	375,346	94,448	1,006,266	65,126	1,857,182	1,857,182	—	18,183	1,875,365	—
Grand Rapids & Indiana	587	2,355,478	1,309,269	3,664,747	3,664,747	505,919	551,919	106,587	1,790,587	132,425	3,127,750	3,127,750	—	400	3,131,150	—
Hocking Valley	350	4,336,648	1,670,608	6,007,256	6,007,256	712,039	866,325	106,587	1,790,587	132,425	3,127,750	3,127,750	—	400	3,131,150	—
Houston & Texas Central	789	3,422,798	1,272,553	5,016,776	5,016,776	704,681	602,920	165,181	2,001,874	194,573	3,649,320	3,649,320	—	1,896	3,651,216	—
Illinois Central	4,570	31,035,728	9,923,866	40,959,594	40,959,594	5,574,053	9,312,290	1,008,987	16,031,340	997,839	32,947,709	32,947,709	—	1,968,470	34,916,179	—
International & Great Northern	1,159	5,066,257	1,632,536	7,138,741	7,138,741	1,044,084	1,043,871	176,888	2,962,200	197,928	5,424,967	5,424,967	—	3,024	5,428,000	—
Iowa Central	559	2,154,026	426,071	2,669,847	2,669,847	310,524	449,874	63,984	1,210,371	77,816	2,022,573	2,022,573	—	88,040	2,110,613	—
Kanawha & Michigan	175	2,033,991	269,229	2,303,220	2,303,220	242,446	414,395	20,551	654,424	111,620	1,394,269	1,394,269	—	68,916	1,463,185	—
Lake Erie & Western	886	3,311,933	692,496	4,004,429	4,004,429	684,294	795,843	139,032	1,644,089	111,620	3,374,878	3,374,878	—	17,762	3,392,640	—
Long Island	395	2,280,770	4,726,642	7,007,412	7,007,412	861,314	1,051,599	131,746	2,363,243	208,035	5,865,099	5,865,099	—	519,278	6,384,377	—
Minneapolis & St. Louis	1,027	2,791,477	940,862	3,989,309	3,989,309	408,500	506,000	99,763	1,583,154	135,778	2,733,154	2,733,154	—	307	2,733,461	—
Missouri, Kansas & Texas	1,737	8,829,276	3,703,273	13,532,549	13,532,549	1,718,188	1,901,086	338,133	4,482,244	395,215	8,834,836	8,834,836	—	452	8,835,288	—
Missouri, Kansas & Texas of Texas	1,348	5,170,863	2,902,293	8,073,156	8,073,156	1,285,219	1,605,543	206,229	4,028,323	314,935	6,440,254	6,440,254	—	5,935	6,446,189	—
Missouri Pacific	3,921	13,151,513	3,582,184	18,633,697	18,633,697	2,921,068	2,952,639	530,667	8,687,212	632,995	15,724,581	15,724,581	—	21,500	15,746,081	—
Mobile & Ohio	1,114	6,085,610	1,096,299	8,359,491	8,359,491	971,882	1,450,663	294,306	2,876,846	310,913	5,904,611	5,904,611	—	12,564	5,917,175	—
Morgan's La. & Texas R. R. & S. Co.	4,043	2,773,146	916,202	3,922,583	3,922,583	529,101	462,320	101,638	1,360,812	123,040	2,576,826	2,576,826	—	12,731	2,589,557	—
Nashville, Chattanooga & St. Louis	1,230	6,539,204	2,165,950	9,227,3,												

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

L. S. Thorne, vice-president and general manager of the Texas & Pacific, with office at Dallas, Tex., has been retired. See item under Operating Officers.

A. J. Mitchell, secretary and treasurer of the Niagara, St. Catharines & Toronto, at Toronto, Ont., has been appointed assistant to the vice-president of the Canadian Northern, with office at Toronto.

R. F. Whitman has been elected president of the Tennessee & North Carolina with office at Philadelphia, Pa., succeeding J. B. Hart. James G. Campbell succeeds J. D. Lacey as vice-president, with office at New York, and David G. Wilson, succeeds C. R. Drewry as secretary and treasurer, with office at Philadelphia. A. J. McMahon remains as superintendent and auditor, with office at Newport, Tenn.

Operating Officers.

F. E. Jones, chief train dispatcher of the Tonopah & Goldfield, has been appointed also trainmaster, with office at Goldfield, Nev.

Lee H. Landis, formerly general manager of the Phoenix & Buckeye, now part of the Arizona Eastern, has been appointed general manager of the Ocean Shore Railroad, with office at San Francisco, succeeding A. H. Otis, resigned.

C. S. Cunningham, joint superintendent of the Grand Trunk and the Wabash Railroad, at St. Thomas, Ont., has been appointed acting superintendent of the Western division of the Grand Trunk, with office at Detroit, Mich., succeeding F. W. Egan, granted leave of absence on account of ill health.

Incident to the election of T. J. Freeman as first vice-president of the Texas & Pacific, L. S. Thorne, vice-president and general manager, has retired. J. W. Everman, assistant general manager at Dallas, Tex., has been appointed general superintendent, in charge of operating and transportation departments, with office at Dallas. Page Harris, division superintendent at New Orleans, La., has been appointed assistant general superintendent, with office at Dallas.

C. G. Bowker, assistant superintendent of the Grand Trunk, at London, Ont., has been appointed joint superintendent of the Southern division of the Grand Trunk and the Wabash Railroad, with office at St. Thomas, succeeding C. S. Cunningham, transferred. W. R. Davidson, trainmaster at Hamilton, has been appointed trainmaster, with office at London, succeeding to the duties of Mr. Bowker, and C. H. Brown has been appointed assistant trainmaster, with office at Hamilton, and the offices of assistant superintendent at London and trainmaster at Hamilton have been abolished.

Guy H. Alexander, who was recently appointed superintendent of car service of the New York Central & Hudson River, with office at New York City, as has been announced in these columns, was born November 8, 1868, at Mobile, Ala., and was educated in the public schools of his native town. He began railway work February 1, 1886, as stenographer and clerk in the auditor's office of the Mobile & Ohio, and three years later was appointed chief clerk in the superintendent's and general superintendent's office. From June, 1894, to October, 1901, he was chief clerk in the superintendent's office of the Rome, Watertown & Ogdensburg division of the New York Central & Hudson River, and was then appointed a traveling auditor. In December, 1906, he was appointed car accountant, which position he held at the time of his recent appointment as superintendent of car service.

Harry D. Earl, whose appointment as superintendent of the St. Louis Southwestern Railway, of Texas, with office at Mt. Pleasant, Tex., has been announced in these columns, was born March 28, 1879, at Martin, Ohio. He received a common school education and in June, 1896, began railway work at Amherst, Ohio, in the operating department of the Lake Shore & Michigan Southern. He was later for one year operator for the Toledo,

St. Louis & Kansas City, now the Toledo, St. Louis & Western, and went with the St. Louis Southwestern in September, 1898, as an operator at Sherman, Tex.; he was later transferred to Commerce, Tex., and was then consecutively promoted to train dispatcher at Commerce and Mt. Pleasant, chief dispatcher at Mt. Pleasant, and for three years from June, 1907, was trainmaster at Tyler, Tex. He was promoted to assistant superintendent at Tyler in April, 1910, from which office he is now advanced to superintendent as above.

Traffic Officers.

R. D. Reeves has been appointed assistant general freight agent of the southern lines of the Illinois Central and the Yazoo & Mississippi Valley, with office at Memphis, Tenn.

C. R. Lonergan, general agent in the freight department of the Northern Pacific, at Tacoma, Wash., has been appointed general agent, with office at Spokane, Wash., succeeding J. O. Dalzell. Devan Rowan, chief clerk and secretary to the assistant general freight agent at Portland, succeeds Mr. Lonergan.

T. G. Roehm, chief clerk in the passenger department of the Chicago, Burlington & Quincy at St. Louis, Mo., has been appointed assistant general passenger agent of the Chicago & Alton



T. G. Roehm.

and the Toledo, St. Louis & Western, with office at St. Louis, effective May 22, succeeding C. R. Murray, resigned. Mr. Roehm was born on July 25, 1871, at Ann Arbor, Mich., and entered railway service in February, 1890, with the Chicago, Burlington & Quincy at Ottumwa, Ia. From August, 1891, to June, 1893, he was connected with the Chicago, Milwaukee & St. Paul, and on the latter date returned to the Chicago, Burlington & Quincy as secretary to the general passenger agent. Later he was made assistant chief clerk of the general passenger department at Chicago and in July, 1905, was appointed chief clerk of the passenger department at St. Louis, which position he now resigns to become assistant general passenger agent of the Chicago & Alton and the Toledo, St. Louis & Western.

Engineering and Rolling Stock Officers.

The title of W. H. Snyder, general foreman, mechanical department, of the Tonopah & Goldfield, at Goldfield, Nev., has been changed to master mechanic.

C. H. Jones, assistant resident engineer of the Western Maryland, has been appointed chief engineer of the New York & Pennsylvania, with office at Canisteo, N. Y.

J. B. Elliott, master mechanic of the Baltimore & Ohio, at New Castle Junction, Pa., has been appointed master mechanic at the Glenwood shops, Pittsburgh, succeeding J. F. Prendergast, resigned.

A. M. Darlow, round house foreman of the Chicago & Eastern Illinois, at Danville, Ill., has been appointed mechanical engineer of the Buffalo & Susquehanna Railroad, with office at Galeton, Pa.

John Garrity, division roadmaster of the Great Northern, at Marcus, Wash., has been transferred to Whitefish, Mont., succeeding J. H. Conlen, transferred. F. W. Stiles, assistant roadmaster at Everett, Wash., succeeds Mr. Garrity.

A. N. Willsie, superintendent of the Hannibal division of the Chicago, Burlington & Quincy at Hannibal, Mo., has been appointed master mechanic of the Omaha division, with office at Omaha, Neb., succeeding E. D. Andrews, resigned.

Walter Wells, master carpenter of the Chicago division of the Chicago, Burlington & Quincy, has been transferred to the track elevation department and his former title has been abolished, the duties of that office being assumed by the master carpenter of the Aurora division.

J. H. Cummings, roadmaster of Divisions 4 and 5 of the Buffalo, Rochester & Pittsburgh, at Punxsutawney, Pa., has been appointed roadmaster of Division 4, and George T. Tweed, extra gang foreman, has been promoted to roadmaster of Division 5, both with offices at Punxsutawney.

Silas Zwright, whose appointment as general master mechanic of the Northern Pacific, with office at St. Paul, Minn., has been announced in these columns, was born in May, 1866, at La Crosse, Wis. He was educated in the common schools and at La Crosse Business College, and began railway work in April, 1887, with the Chicago, Burlington & Northern, now part of the Chicago, Burlington & Quincy. The next year he went with the Northern Pacific as a locomotive fireman on the Dakota division, and five years later was made a locomotive engineer. He was promoted to road foreman of engines in August, 1902, and six years later to master mechanic of the St. Paul division. He was transferred to the Rocky mountain division, with office at Missoula, Mont., in December, 1910, from which position he is now advanced to general master mechanic of the lines east of Mandan.

Purchasing Officers.

John E. Mahaney, whose appointment as general storekeeper of the Oregon-Washington Railroad & Navigation Company and the Southern Pacific lines in Oregon, with headquarters at Portland, Ore., has been announced in these columns, was born at St. Paul, Minn., in 1877. He entered railway service in 1894 as messenger boy in the store department of the Minneapolis, St. Paul & Sault Ste. Marie, remaining with that company six and one-half years as stock clerk in the store department and division storekeeper. He was then for a year and a half general foreman of the store department of the Great Northern at West Superior, Wis., and later with the Chicago, Rock Island & Pacific as clerk in the purchasing department for six months, foreman in the store department one year and general foreman one year. Subsequently until April 25, 1911, he was successively general foreman in the store department of the Southern Pacific and division storekeeper, which position he held at the time of his appointment as general storekeeper of the Oregon-Washington Railroad & Navigation Co.



J. E. Mahaney.

OBITUARY.

Henry McFarland, secretary and treasurer of the Union Pacific from 1877 to 1888, died at Concord, N. H., on May 15, at the age of 80 years.

Charles Guille Warner, formerly second vice-president of the Missouri Pacific, died at St. Louis, Mo., on May 13. Mr. Warner was born December 28, 1844, at Zanesville, Ohio, and began railway work in 1868 with the Missouri Pacific, having served during the Civil war as a captain in the United States army. He held several different railway positions and in 1877 was made an auditor, and three years later general auditor of the Missouri Pacific, holding the latter office until December, 1899. He was second vice-president from 1893 to March, 1905, when he retired on account of ill health.

Railway Construction.

New Incorporations, Surveys, Etc.

ALBERTA ELECTRIC.—The Canadian parliament has passed the bill permitting this company to build from Medicine Hat, Alb., northwest via Calgary to Banff, about 260 miles. The company was incorporated last October with a capital of \$10,000,000, and it is understood will at once commence work on the section from Calgary, west to Banff, 80 miles. It is expected that this work will be finished in about 18 months. (November 4, p. 886.)

ARIZONA & GULF.—This company, which was organized to build from Port Lobos, Sonora, Mex., to Sasabe, on the international boundary, has been granted an extension of two years from April, 1911, for completing the first section of 31 miles. The route has been changed from Sasabe to a point about 30 miles west of that place, and the company has been granted permission to construct a branch via Sasabe to Altar, Sonora.

ATCHISON, TOPEKA & SANTA FE COAST LINES.—A contract is said to have been given to George West, San Bernardino, Cal., for rebuilding the roadbed between Fresno, Cal., and Merced, 58 miles.

ATLANTIC COAST LINE.—Work is now under way, it is said, at the Altamaha river between Waycross, Ga., and Savannah, to include replacing the wooden trestle work over the Altamaha river and the swamps and lakes with concrete and steel structures. Work is also under way at Black Gum swamp, east of the river. These improvements are being carried out in connection with the proposed double tracking work from Folkston to Savannah.

BOSTON & WESTERN ELECTRIC.—Under this name a company has been formed to build from Waltham, Mass., west to Marlboro, about 20 miles. It is said an agreement has been reached with the Boston & Maine to use the Central Massachusetts right-of-way from Waltham to South Sudbury.

CALIFORNIA ROADS (Electric).—A line is projected from Jackson, Cal., northeast to Sacramento, about 50 miles. C. P. Vicini, is said to be interested.

CHICAGO, MEMPHIS & GULF.—An officer writes that work has been finished on the line into Hickman, Ky., and the road is now completed from Dyersburg, Tenn., on the Illinois Central, north to Hickman, on the Nashville, Chattanooga & St. Louis, 52 miles. The company is about to let contracts for an extension northeast to Clinton, 15 miles. Connection is to be made with the Mobile & Ohio at Stubbs.

CHICAGO, MILWAUKEE & PUGET SOUND.—A contract is said to have been given by this company to Bates & Rogers, Spokane, Wash., for piercing a 650-ft. tunnel under Front street, in Spokane.

CHICAGO, WAUKEGAN & WOODSTOCK TRACTION.—Incorporated in Illinois with \$50,000 capital and office at Chicago. The plans call for a line from Waukegan county through Lake and McHenry counties to Woodstock. The incorporators include C. A. Spenny, Columbus, Ohio; I. D. Stevens, W. P. MacCracken, P. B. Olson and H. S. Meddger, all of Chicago.

CONEWAGO & SOUTHERN.—Incorporated in Pennsylvania with \$150,000 capital, to build from Biglerville, Adams county, Pa., southwest to Cashtown, eight miles. H. W. Hamblin, president, Harrisburg. The directors include: M. A. Garvin, Gettysburg; J. H. Vreeland, Harrisburg; J. A. Deardorf, Cashtown, and J. A. Kane, Arendtsville.

EAST ST. LOUIS INTERURBAN.—Incorporated in Illinois with \$2,500 capital and office at East St. Louis, Ill. The plans call for a line from East St. Louis, easterly through St. Clair and Clinton counties. The incorporators include: J. L. Flannigan, W. H. Haus, F. W. Kraft and E. L. Cragen, all of East St. Louis.

ERIE RAILROAD.—An officer writes that contracts have been let for constructing grade for second-track as follows: Bates & Rodgers, Chicago, on the Cincinnati division, from Milton, Ohio, to Summit, 6.5 miles, and from Creston to Q. M. Tower, 9.2 miles; to Ferguson & Edmondson, Brookville, Pa., from West

Salem, Ohio, to Polk, 5.4 miles, and to the Robert Grace Co., Cleveland, from Barberton to Sherman, 2.7 miles, and from Tallmadge to Hills, three miles.

EVERETT RAILWAY (Electric).—E. Goode, Los Angeles, Cal., is planning to build a number of lines in the Glendale district. Under the name of the Everett Railway, a line is to be built from Glassell ranch to a connection with the Glendale—Eagle Rock line in Glendale. Other lines are to be built from Glendale to Scholl canyon and from Glendale to Griffith Park, in Los Angeles.

GRAFTON, FAIRMONT & CLARKSBURG (Electric).—An officer writes that surveys are now being made and it is expected to let contracts in the near future to build a 50-mile line from Grafton, W. Va., west to Clarksburg, thence north east to Fairmont. The company will build a power house. Charles F. Sutherland, president, and Arthur Stealy, chief engineer, Morgantown.

GREAT NORTHERN.—L. W. Hill, president of this company, is quoted as saying that the only work planned by the Hill lines to be carried out in Oregon at the present time is the completion of the United Railways Company's lines to Tillamook bay and the continuation of work on the Oregon Electric from Salem to Eugene.

GULF, COLORADO & SANTA FE.—According to press reports, this company has under consideration the question of building a branch from Carthage, Texas, northeast to Shreveport, La., about 50 miles.

GULF, FLORIDA & ALABAMA.—This company was incorporated in Florida to operate a line from deepwater at Pensacola, Fla., north through the timber and agricultural districts of Florida and Alabama and the coal and iron fields of northern Alabama to Jasper, Ala., about 265 miles. Franchises and rights-of-way have been secured, the property has been bought upon which stations, piers, etc., are to be built between Pensacola and Muscogee, 18 miles, and work is now under way. When work on this section is finished the company will have a line over 80 miles long north to Fremansville, Ala., which is then to be put in operation. Megargel & Co., New York, are the bankers.

JEFFERSON & NORTHWESTERN.—According to press reports from Jefferson, Texas, this company will build a line through Cass county, to Linden. Right-of-way has been secured and contracts to build the line have been let.

LEXINGTON & EASTERN.—See Louisville & Nashville.

LOS ANGELES & REDONDO.—See Pacific Electric.

LOUISVILLE & NASHVILLE.—A contract is said to have been let to Buffat & Nipper, contractors, Knoxville, Tenn., for building an extension of the Lexington & Eastern from Whitesburg, Ky., to Dryfolk, six miles. The work will be difficult, being mostly through rock. It is understood that the contract is worth \$350,000.

An officer is quoted as saying that double tracking work on the Kentucky Central division will be started about June 1. Much of the right-of-way has been secured to carry out this improvement.

MARKED TREE, HARRISBURG & NEWPORT (Electric).—An officer writes that this company will build from Marked Tree, Ark., west via Harrisburg to Newport, about 50 miles. There will be five miles of hill work. J. C. Mitchell and L. D. Freeman, Harrisburg, are interested.

MATANZAS TERMINAL RAILROAD.—Incorporated in Maine with \$50,000 capital and headquarters at Havana, Cuba, to build a steam or electric railway at Matanzas. Horace Mitchell, Kittery, Me., is president and clerk, and C. E. Smothers, Portsmouth, N. H., is treasurer.

NORTH COAST.—See Oregon-Washington Railroad & Navigation Company.

OREGON ELECTRIC.—This company is said to have secured terminal facilities at McMinnville, Ore., and a branch from the main line is to be built southwest to that place.

OREGON ELECTRIC.—See Great Northern.

OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY.—Contracts are said to have been let to Caughren, Boynton & McCoy, for the concrete work on the North Coast, from Spokane,

Wash., to Ayer, and work is to be started at once. The Puget Sound Bridge & Dredge Company will have charge of the erection of the large bridge over the Snake river. (May 12, p. 1133.)

PACIFIC ELECTRIC.—This company operates the Los Angeles & Redondo Railway, it is said, and will four-track the line from Redondo Beach, Cal., to Homewood, near Los Angeles. A new line is to be built from Homewood to Watts, on the Pacific Electric.

PORTERVILLE NORTHEASTERN.—It is expected that this company will finish work by July 1 on the line now under construction from Porterville, Cal., to Springville, Tulare county, 16 miles. The Utah Construction Co., Ogden, Utah, are the contractors. Stations are to be put up at Worth, Globe, McFarland and Springville. F. U. Nofziger, president and C. S. Freeland, chief engineer, Porterville. (Dec. 30, p. 1281.)

RALEIGH, CHARLOTTE & SOUTHERN.—This company was incorporated in North Carolina to build from Charlotte, N. C., northeast to Raleigh, about 140 miles, with a branch from Pittsboro northwest to Greensboro, 55 miles. Part of the construction work will be difficult. There will be six steel bridges. It has not yet been decided when contracts for the work will be let, but the prospects of building the line are good. The principal commodities to be carried are lumber, fruit and vegetables. W. L. Mann, Albemarle, N. C., is an incorporator.

RALEIGH & SOUTHPORT.—An officer writes that work is to be started at once on a branch from Lillington, N. C., west to Sanford, about 25 miles. The company will carry out the work with its own men.

TENNESSEE & NORTH CAROLINA.—An officer writes that this company, which operates a 21-mile line from Newport Junction, Tenn., south to Crestmont, N. C., is planning to build an extension from Waterville, southeast to Canton, 38.5 miles.

TEXAS ROADS.—C. H. Beatty, Ogden, Utah, is said to be back of a project to build between Austin, Texas, and Fredericksburg, about 80 miles. It is understood that the line will be built if \$180,000 in bonuses can be raised, and land for two townsites is donated. The people of Fredericksburg have had a standing offer for some time of \$100,000 to any railway company that will build from that place to Austin or San Antonio.

It is announced that surveys are being made by the Rio Grande Construction Company for a line between Eagle Pass, Tex., and Brownsville. The route follows the valley of the Rio Grande, via the towns of Laredo, Roma and Rio Grande City. The line will open to development territory that is now lacking railway transportation facilities. A. W. Liliendahl, Saltillo, Mex., is back of the project. (April 21, p. 970.)

TOWSON & COCKEYSVILLE.—An officer writes that contracts have been let to the James H. Harlow Co., to build from Towson, Md., north via Lutherville and Texas to Cockeysville, 7.5 miles. Maximum grades will be 3 per cent., and maximum curvature 6 deg. There will be an 80-ft. steel bridge and a concrete under-grade crossing. J. A. Shriver, president, Bel Air.

UNITED RAILWAYS COMPANY.—See Great Northern.

WASATCH RAILROAD.—Under this name a company will ask for incorporation in Utah to build about six miles of line from San Pitt, Utah, to Wasatch. J. G. Jacobs is said to be back of the project.

WASHINGTON ROADS (Electric).—An electric railway system is planned at Pasco, Wash., with an extension east to Walla Walla, and another extension south to Pendleton, Ore. A. M. Wehe, Milwaukee, Wis., is said to be back of the project.

According to press reports an electric line is projected from Pateros, Okanogan county, Wash., southwest to Wenatchee, about 60 miles. An extension is projected north to Concully, 40 miles. O. A. Hoag, Chelan, is said to be back of the project.

The section of the Melipilla to San Antonio Railway, Chile, extending as far as Lloleco, was opened to traffic in October, and on December 4 the railway from Rayado to Papudo was inaugurated. During the year the railway from Alcones to Lingue was turned over to the government.

Railway Financial News.

BOSTON & MAINE.—Referring to the rumors which have followed reduction of the Boston & Maine dividend and its effect upon the New Haven, President Mellen says:

"Boston & Maine just before beginning of present fiscal year, July 1, 1910, increased wages of employees by about \$2,700,000, equivalent to more than 6 per cent. on increased stock—about \$40,000,000. Reduction of maintenance was impossible because of condition of the property. There, therefore, remained only the possibility of reduction in cost of conducting transportation, and reduction there materially to offset increase in wages was practically impossible without a serious cut in the train service. Result of nine months' operation has shown practically no dividend earned, and directors would have been justified in discontinuing all dividends for the immediate future had they not been impressed with hardship that would have resulted to many smaller stockholders, and belief that upon rehabilitation of the property earnings would be sufficiently in excess of dividend requirements to replace such amount as would be disbursed in dividends while rehabilitation was in progress.

"The company has a profit and loss account, sufficient, probably, to warrant continuance of a 4 per cent. rate, until business revives and improved condition of property will result in a more efficient and economical service, which will be reflected in the net earnings."

CENTRAL NEW ENGLAND.—J. P. Morgan & Co., the National City Bank and the First National Bank, all of New York, are offering \$11,927,000 first mortgage four per cent. bonds of 1911-1961, guaranteed principal and interest by the New York, New Haven & Hartford at 93½.

CHICAGO, ROCK ISLAND & PACIFIC.—This company has formally taken over the St. Paul & Des Moines.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—The New York Stock Exchange has been asked to list \$1,500,000 first mortgage 5 per cent. bonds. The entire issue has been sold by the company and the proceeds used to pay the cost of the Superior Short Line Railway, now a part of the C. St. P. M. & O.

DENVER, NORTHWESTERN & PACIFIC.—The Denver Securities Company has been formed in Denver, Colo., for the purpose of taking over the Moffatt estate interests in the Denver, Northwestern & Pacific. The \$4,000,000 notes of the Colorado-Utah Construction Company, guaranteed by the late David H. Moffatt, which matured May 1, and on which interest was paid but not principal, is expected to be extended under some arrangement for one year.

ENID, OCHILTREE & WESTERN.—The District Court at Dalhart, Tex., has ordered the property and franchises of this company sold to pay the company's debts. The company was chartered to build from Dalhart, Tex., to Enid, Okla. A good part of the grading has been completed and some track has been laid in Texas.

INTERCOLONIAL.—A press despatch says that G. P. Graham, minister of railways, has given notice of the introduction in the Canadian House of a measure providing for the leasing of thirteen of the railways to be operated as branches of the government owned Intercolonial. This will add more than 650 miles to the Intercolonial. The lines to be leased are: The Yale Railway, from New Glasgow, N. S., to Thoburn; the Quebec Oriental, from Matapedia to Parpediac; the Hampton & St. Martin's, from Hampton to St. Martin's; the Albert Railway, from Salisbury to Albert; the Moncton & Buctouche, from Moncton to Buctouche; the Carequet & Gulf Shore, from Bathurst to Acadia; the York & Carleton, from Cross Creek to and beyond Stanley; the International Railway, from Campbellton to the St. John valley, at St. Leonards; the Temiscouata, from Point Tupper to St. Peter's; the Temiscouata Railway, from River du Loup to Connors; the New Brunswick & Prince Edward Island, from Sackville Junction to Cape Tormentine; the Elgin & Havelock Railway, from Elgin to Havelock; the Kent Northern, from Kent Junction to Richibucto.

INTERNATIONAL & GREAT NORTHERN.—The third mortgage bondholders protective committee, consisting of Alvin W. Krech, Edward T. Jeffrey and Frank J. Gould, has presented a plan of reorganization, under which they agree to buy for cash at par and interest, the second mortgage bonds represented by the protective committee, of which W. Emlen Roosevelt is chairman. The plan is to become effective unless 50 per cent. of the deposited third mortgage bondholders object.

The present capitalization of the International & Great Northern totals \$45,600,413, of which \$11,291,000 is first mortgage 6 per cent. bonds due November 1, 1919, and \$240,000 Colorado bridge 7's and San Antonio station loans; \$668,650 is equipment obligations and receivers' certificates; \$10,391,000 second mortgage bonds with \$2,516,644 overdue interest; \$2,961,000 third mortgage bonds with \$942,056 overdue interest; \$6,835,063 floating debt and unpaid vouchers; and \$9,755,000 stock.

The capitalization of the new company will aggregate \$35,457,000, which includes \$11,291,000 first mortgage 6 per cent. bonds and the \$240,000 Colorado bridge 7 per cent. bonds and the San Antonio loan which will remain undisturbed.

The estimated cash requirements for the reorganization total \$15,340,000 and will be raised by the sale of \$3,400,000 new preferred stock and \$2,500,000 common stock, and by the sale of \$11,000,000 three year 5 per cent. notes and by the sale to a syndicate of \$1,600,000 new first refunding mortgage bonds. The \$15,340,000 cash raised under this plan will permit the new company to pay off at par and accrued interest the second mortgage bonds now outstanding to pay for the company's equipment certificates, its vouchers and claims; to pay reorganization expenses and give it working capital to start with.

The \$11,000,000 notes mentioned above are secured by the deposit of \$12,150,000 first refunding mortgage bonds deposited by the railway company and the deposit by the syndicate of the \$1,600,000 bonds mentioned above as sold to the syndicate. The new company therefore will have issued \$13,750,000 first and refunding mortgage bonds and \$9,900,000 stock, as noted, and \$276,000 10-year equipment trust certificates. The annual fixed charges will aggregate \$1,349,840.

The syndicate mentioned above is under the management of the Equitable Trust Company, New York.

The \$11,000,000 notes mentioned above have been sold by the company to Redmond & Co., J. & W. Seligman & Co., both of New York, and Middendorf Williams & Co., Baltimore; and have been resold by the bankers at 99¼, which yields 5¾ per cent. interest on the investment.

The foreclosure sale has been postponed from May 16 to June 13.

KANSAS CITY, FORT SCOTT & MEMPHIS.—William Salomon & Co., New York, have bought sufficient 4 per cent. refunding bonds of the K. C. F. S. & M. to retire \$2,055,300 Kansas City, Fort Scott & Gulf first mortgage 5 per cent. bonds due June 1, and are offering to exchange the new refunding 4 per cent. bonds for the old 5 per cent. bonds, taking the old bonds at the market price, which would make the new bonds yield about 5.42 per cent. on the investment.

KANSAS CITY SOUTHERN.—James A. Blair has been elected to the executive committee, succeeding D. B. Boissevain, resigned.

NEW YORK, NEW HAVEN & HARTFORD.—See Boston & Maine.

PARIS & MOUNT PLEASANT.—The Texas Railway Commission has authorized the company to register \$369,479 bonds to be secured on the 25 miles of completed line from Paris to Bogota and has authorized the company to issue \$120,000 additional bonds on the completion of improvements.

ST. PAUL & DES MOINES.—See Chicago, Rock Island & Pacific.

TRINITY & BRAZOS VALLEY.—B. W. Beckham has been elected a director, succeeding L. W. Carr, resigned.

ULSTER & DELAWARE.—The State of New York has agreed to pay the Ulster & Delaware \$1,500,000 damages for the removal of the tracks from Ashokan dam. This is one-half the amount asked by the railway company.

Supply Trade Section.

The Forsyth Brothers Company, Chicago, has moved its general offices from 213 Institute place to the McCormick building.

Clarence A. Bartlett has gone to the Garry Iron & Steel Company, Niles, Ohio, as sales agent, with office in Philadelphia, Pa.

The Chicago-Cleveland Car Roofing Company, Chicago, has moved its general offices from the Old Colony building to the Peoples Gas building.

The Willard Storage Battery Company, Cleveland, Ohio, has moved its Detroit, Mich., office from 227 Jefferson avenue to larger quarters at 1191 Woodward avenue. The office will be in charge of Max. G. Hilman.

H. C. Ware has been made superintendent of construction of the western district of the Federal Signal Company, Albany, N. Y., with office in Chicago. J. J. Hubbard has been made superintendent of construction of the eastern district of this company, with office in Albany.

Charles F. Palmer has been made sales manager of the J. Faessler Manufacturing Company, Moberly, Mo., with office in St. Louis, Mo. Mr. Palmer has had previous experience in selling Faessler boiler tools and has also been a representative of the Frank E. Palmer Supply Company, St. Louis.

The McKean Motor Car Company, Omaha, Neb., has received an order from the Sand Springs Interurban, Tulsa, Okla., for a second 70-ft. motor car, and an order from the Peoples' Electric Railway, Muskogee, Okla., for two 70-ft. motor cars. There are now 108 of these cars in service in the United States and Mexico.

The General Electric Company, Schenectady, N. Y., has received orders from the Boston Elevated for the following equipment of its new power station at South Boston, Mass.: Two 15,000 kw. 6600-volt 25-cycle turbo-alternators, six 25000 kva compensators, and two motor-operated rheostats. The station will supply power to seven rotary converter railway sub-stations.

Judge Kohlsaat, in the circuit court for the northern district of Illinois, entered a decree on May 11, sustaining the Hardie patent which covers the Andrews side frame, made by the American Steel Foundries, Chicago, and holding that the Wolff truck frame, made under the Harrington patent by the Scullin-Gallagher Iron & Steel Company, St. Louis, Mo., was an infringement.

The United States Circuit Court of Appeals for the Second circuit, in the suit of the Simplex Railway Appliance Company, Chicago, against the Pressed Steel Car Company, Pittsburgh, Pa., handed down an opinion on May 9, affirming the decision of the circuit court, which sustained the Bauer patent covering the Simplex bolster and holding that the Reliance bolster, made by the Pressed Steel Car Company, was an infringement.

The Merchants' Despatch Transportation Company, New York, was incorporated on May 11 with \$5,000,000 capital. This company, which is a subsidiary of the New York Central, will take over the assets of the old company and will build refrigerator cars for its own use, for the New York Central, and for lease. It is expected, however, that the New York Central's requirements will keep the plant too busy to accept outside orders.

The Traveling Engineer's Supply Men's Association has reserved the entire second floor of the Sherman Hotel, Chicago, for exhibits during the eighteenth annual convention of the Traveling Engineer's Association to be held in that hotel August 29 to September 1, inclusive. Approximately 8,000 sq. ft. of floor space will be available for exhibits, and numerous applications for space have already been received. Power for live exhibits will be furnished by the hotel at a nominal charge. The Traveling Engineer's Association has a total membership of 750, and it is planned to make the coming convention the best in the history of the organization.

It is understood that in the tentative plans for the reorganization of the Baldwin Locomotive Works, Philadelphia, Pa., the capitalization has been fixed on a basis of the earning power of the company. This has ranged from \$4,000,000 up to \$6,000,000 net per annum in the last five years. The new company will therefore be chartered with \$40,000,000, half preferred and half common. The incorporators are to be Rudolph Ellis, president of the Fidelity Trust Company; Charles S. W. Packard, president of the Pennsylvania Company for the Insur-

ance of Lives and Granting Annuities; Eckley B. Cox, Jr., Alfred C. Harrison and Herman Dercum. John G. Johnson is acting as counsel in the organization of the new company. This new company will buy outright from the men who now own the property the entire \$20,000,000 stock of the Baldwin Locomotive Works.

John Reis, whose election to the vice-presidency of the United States Steel Corporation, succeeding William B. Dickson, was mentioned in the *Railway Age Gazette* of May 5, was born in

Niles, Ohio, in 1861. After leaving school, Mr. Reis began work in the New Castle Iron Works, operated by two of his brothers under the firm name Reis Brothers. He learned the trade of sheet and plate rolling and at the Neshannock furnace, also operated by Reis Brothers, acquired a knowledge of blast furnace practice. In 1886 Mr. Reis was made vice-president and general manager of the Gogebic Furnace Company, Iron River, Mich., manufacturers of charcoal pig iron, and two years later became manager of the Nashville Iron, Steel & Charcoal Com-



John Reis

pany, with furnaces at West Nashville, Tenn. In 1889 Mr. Reis went to the Tennessee Coal, Iron & Railroad Company, Birmingham, Ala., as manager of the Alice furnace. In 1891 he had charge of the blast furnaces of the Watts Iron & Steel Syndicate, Middlesboro, Ky. In 1893 he went to the Oliver Iron & Steel Company, Pittsburgh, Pa., as manager of the Edith furnace. In 1889, on the formation of the National Steel Company, Mr. Reis was made general manager of all blast furnace operations of this company, which included 16 active furnaces. In 1901, when the United States Steel Corporation was formed, the operation of the plants of the National Steel Company was taken over by the Carnegie Steel Company, Pittsburgh, and Mr. Reis was made general superintendent of the Shenango Valley district, which included all blast furnaces, steel works and rolling mills at New Castle, Pa., and Sharon. In 1905 he was made assistant to President William E. Corey, of the Steel Corporation. As vice-president he continues in charge of construction, in addition to other duties connected with that office.

TRADE PUBLICATIONS.

Lock Washers.—The Reliance Manufacturing Company, Massillon, Ohio, has published a very full catalog of its lock washers. Illustrations and price lists are included.

Gas Engines.—The Mesta Machine Company, Pittsburgh, Pa., in a small illustrated booklet discusses the characteristic features and advantages of Mesta gas engines. In the back of this booklet gas is contrasted to steam.

Culverts.—The Canton Culvert Company, Canton, Ohio, has published a folder illustrating and describing its Acme (Nestable) corrugated No-Co-Ro metal culverts. Photographs are given showing divers installing these culverts under water.

Car Wheels.—The Nickel-Chrome Chilled Car Wheel Company, Pittsburgh, Pa., has devoted a small booklet to the advantages of the Improved nickel-chrome chilled car wheels. The subject is thoroughly discussed and some interesting results of tests are included.

Bridges.—The Strauss Bascule Bridge Company, Chicago, has issued Bulletin No. 3, which contains a complete list of the bridges designed and built by this company, as well as those that are now under construction. It includes numerous photographs of Strauss bridges in various parts of the world.

RAILWAY STRUCTURES.

ALBINA, ORE.—The Oregon-Washington Railroad & Navigation Company has given a contract to W. N. Concanon, San Francisco, Cal., for improvements and additions, to include new buildings at the Albina yards near Portland. The improvements, it is understood, will cost about \$50,000.

CHICAGO, ILL.—The Chicago, Burlington & Quincy has bought property at the southwest corner of Jackson boulevard and Clinton street, Chicago, with 150 ft. frontage on Jackson boulevard and 175 ft. frontage on Clinton street for a new general office building, to be 14 stories high with provision for further stories as required, to contain all general offices which are now scattered in different buildings. Work will be commenced August 1, on wrecking the old buildings, and construction of the new building will be pushed. Marshall & Fox, Chicago, are the architects.

DENISON, TEXAS.—Plans have been made for constructing a subway at a cost of \$11,000, under the tracks of the Missouri, Kansas & Texas, the Houston & Texas Central and the Missouri, Oklahoma & Gulf, in Denison.

ELMHURST, CAL.—The Western Pacific, it is said, will build a station at Elmhurst.

FARGER, ORE.—See Madras, Ore.

GATEWAY, ORE.—See Madras, Ore.

GLENDIVE, MONT.—The Northern Pacific, it is understood, will build a division hospital at Glendive, to cost \$150,000.

GLOBE, CAL.—See Porterville Northeastern under Railway Construction.

HUNTS FERRY, ORE.—See Madras, Ore.

KEMPTON, PA.—The Philadelphia & Reading has given a contract, it is said, to the H. E. Ahrens Company, Reading, for building reinforced concrete bridges at Kempton and at Virginsville.

LAKEVIEW, ORE.—According to press reports, the Nevada-California-Oregon will build a terminal in Lakeview, at a cost of \$100,000. A station is also to be put up at Davis creek near the lower end of Goose lake.

MADRAS, ORE.—The Oregon-Washington Railroad & Navigation Company has let a contract to Moore Brothers, Portland, for putting up five stations on the Des Chutes Railroad as follows: At Hunts Ferry, Gateway, Madras, Paxton and Farger.

McFARLAND, CAL.—See Porterville Northeastern under Railway Construction.

PAXTON, ORE.—See Madras, Ore.

SIDNEY, N. Y.—The Delaware & Hudson is to put up a new station at Sidney, N. Y., next year. This announcement is made by the New York State Public Service Commission, Second district, which has been listening to the complaints of the people against the "eye sore" that now serves as a station at that town. The promise of the company to build a station after a year is referred to as "a most pleasing settlement" of a disturbing question.

SPRINGVILLE, CAL.—See Porterville Northeastern under Railway Construction.

TAMPA, FLA.—An officer of the Tampa Union Station Company writes that a contract has been given to the King Lumber Company, Charlottesville, Va., and work is to be started at once on a brick passenger station, with stone and terra cotta trimmings, at Twigg and Nebraska streets, in Tampa. The building is to be two stories high, 83 ft. x 130 ft., with a 250-ft. wing, and will cost \$120,000. (April 28, p. 1019.)

TEMPLE, TEX.—The Missouri, Kansas & Texas will build a passenger station.

VANCOUVER, B. C.—The Canadian Pacific is said to be making plans for an addition to the freight house at Vancouver. The cost of the improvements will be about \$50,000.

Excavation work has been started for the new station to be built at Vancouver by the British Columbia Electric Railway. The cost of the improvements will be about \$350,000. McDonald & Wilson are the contractors. (July 29, p. 208.)

VIRGINVILLE, PA.—See Kempton, Pa.

WORTH, CAL.—See Porterville Northeastern under Railway Construction.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The *Kansas City Southern*, mentioned in the *Railway Age Gazette* of March 10 as being in the market for 20 locomotives, is now in the market for 11 Pacific type locomotives, 10 consolidation locomotives and 8 Mallet locomotives.

The *Cuba Railroad Company*, New York, has ordered 5 ten-wheel locomotives from the American Locomotive Company. The dimensions of the cylinders will be 18 in. x 24 in., the diameter of the driving wheels will be 52 in., and the total weight in working order will be 127,000 lbs.

The *Brazil Railway Company*, New York, has ordered 6 Mallet compound locomotives from the American Locomotive Company. The dimensions of the cylinders will be 16 in. and 25 in. x 20 in., the dimensions of the driving wheels will be 42 in., and the total weight in working order will be 157,000 lbs.

The *New Orleans & Northeastern Railway* has ordered 2 ten-wheel locomotives, and 3 six-wheel switching locomotives from the Baldwin Locomotive Works. The dimensions of the cylinders of the ten-wheel locomotives will be 21 in. x 28 in., the diameter of the driving wheels will be 58 in., and the total weight in working order will be 180,000 lbs. Two of the switching locomotives will have 21 in. x 26 in. cylinders, 51 in. driving wheels, and in working order will weigh 135,500 lbs. The other switching locomotive will have 20 in. x 24 in. cylinders, 51 in. driving wheels, and in working order will weigh 112,000 lbs.

CAR BUILDING.

The *New York Central & Hudson River* is in the market for 15 coaches.

The *Chicago, Burlington & Quincy* has ordered 1,000 gondola cars from the American Car & Foundry Company.

The *Sydney & Louisburg*, Toronto, Can., has ordered 50 all-steel coal cars from the Canadian Car & Foundry Company.

The *San Francisco, Oakland & San Jose*, Oakland, Cal., has ordered 25 seventy-foot motor coaches from the St. Louis Car Company.

The *Cincinnati, New Orleans & Texas Pacific* is said to be in the market for 27 steel underframe passenger cars and 100 fifty-ton steel hopper-bottom coal cars.

The *Merchants' Despatch Transportation Company*, mentioned in the *Railway Age Gazette* of May 12 as taking prices on 1,000 refrigerator cars, will build this equipment at its shops at East Rochester, N. Y.

IRON AND STEEL.

The *Great Northern* is negotiating for 28,000 tons of rails.

The *Kansas City Southern* is in the market for 14,000 tons of rails.

The *Philadelphia & Reading* is in the market for 5,000 tons of structural steel.

The *Kansas City, Mexico & Orient* has ordered 8,500 tons of rails from the Steel Corporation.

The *Chicago, Indianapolis & Louisville* has ordered 4,000 tons of rails from the Illinois Steel Company.

The *Pennsylvania* has ordered 3,000 tons of structural material from the Pennsylvania Steel Company.

The *Chicago, Rock Island & Pacific* has ordered 2,500 tons of structural steel from the American Bridge Company to be used for bridge renewals.

The *Benton Harbor & St. Joseph Railway & Light Company*, Benton Harbor, Mich., has ordered 1,200 tons of rails from the Illinois Steel Company.

General Conditions in Steel.—The railways placed larger orders last week than in any week since the first of April. The improvement is regarded as temporary, however, for these orders are only for vital requirements. Production continues to exceed consumption, so a further decrease in unfilled tonnage is expected for May. A reduction in the price of bars is looked for this week; not to stimulate buying but to make the price of this product more equitable, as compared with other products.